Consulting Engineer

August 1960

Photo by Fabian Bachrach

ROLAND R. DUQUETTE, president of the Association of Consulting Engineers of Canada and a partner in McDougall & Friedman, Montreal, wants to see his Canadian Association take decisive action on a number of major issues during his term of office. He has a time proven method for bringing this about. One item is selected for each meeting, and Duquette does not hear a motion for adjournment until action is taken.

Continued on Page 14

ONLY ADVAN guard

ADDS YEARS TO BALLAST LIFE

THERMALLY PROTECTED FLUORESCENT LAMP BALLASTS

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World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

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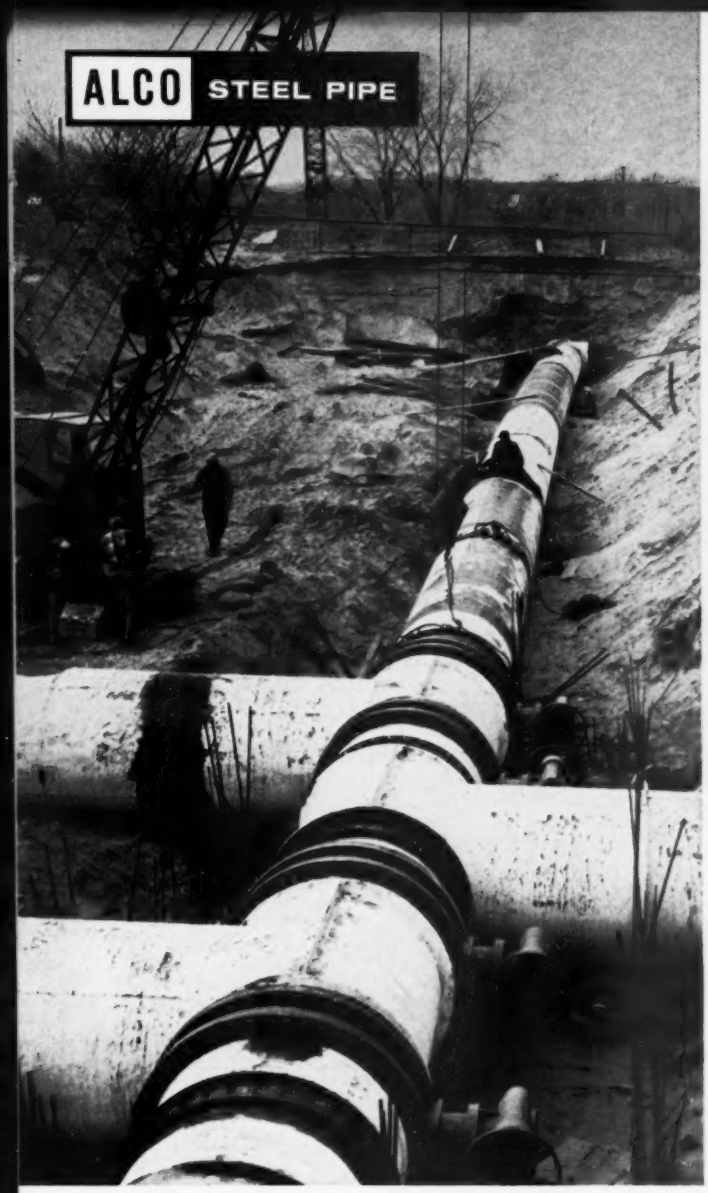

ALCO *steel mains with high-carrying coal-tar-enameled inside surfaces help New York City distribute over a billion gallons of water per day.*

Kansas City, Missouri, will be depending on this ALCO *electric-welded steel pipe far into the twenty-first century.*

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One hundred years is a long time. Yet that is the estimated minimum life of ALCO electric-welded steel pipe in water-supply installations. Because of the strength of steel and the protection of coal-tar enamel, steel pipe lasts longer and maintains its high carrying capacity.

Municipal engineers know from experience that ALCO electric-welded steel pipe is built to absorb vibration, impact and overloading and provide trouble-free, efficient service for many decades. Its smooth, coal-tar-enameled inside surface assures maximum rate of flow.

Not only is first cost low, but installation of ALCO steel pipe is fast and economical. Sections up to 40 ft in length are light weight and require fewer field joints. Breakage during shipment or installation is virtually impossible.

Sizes of ALCO electric-welded steel pipe range from 20 to 120 inches in diameter and from ¼ inch wall up. For your next piping system, specify the pipe with the longer life. For more information, contact your nearest ALCO sales office or write for brochure to: ALCO Products, Inc., Dept. 141, Schenectady 5, N. Y.

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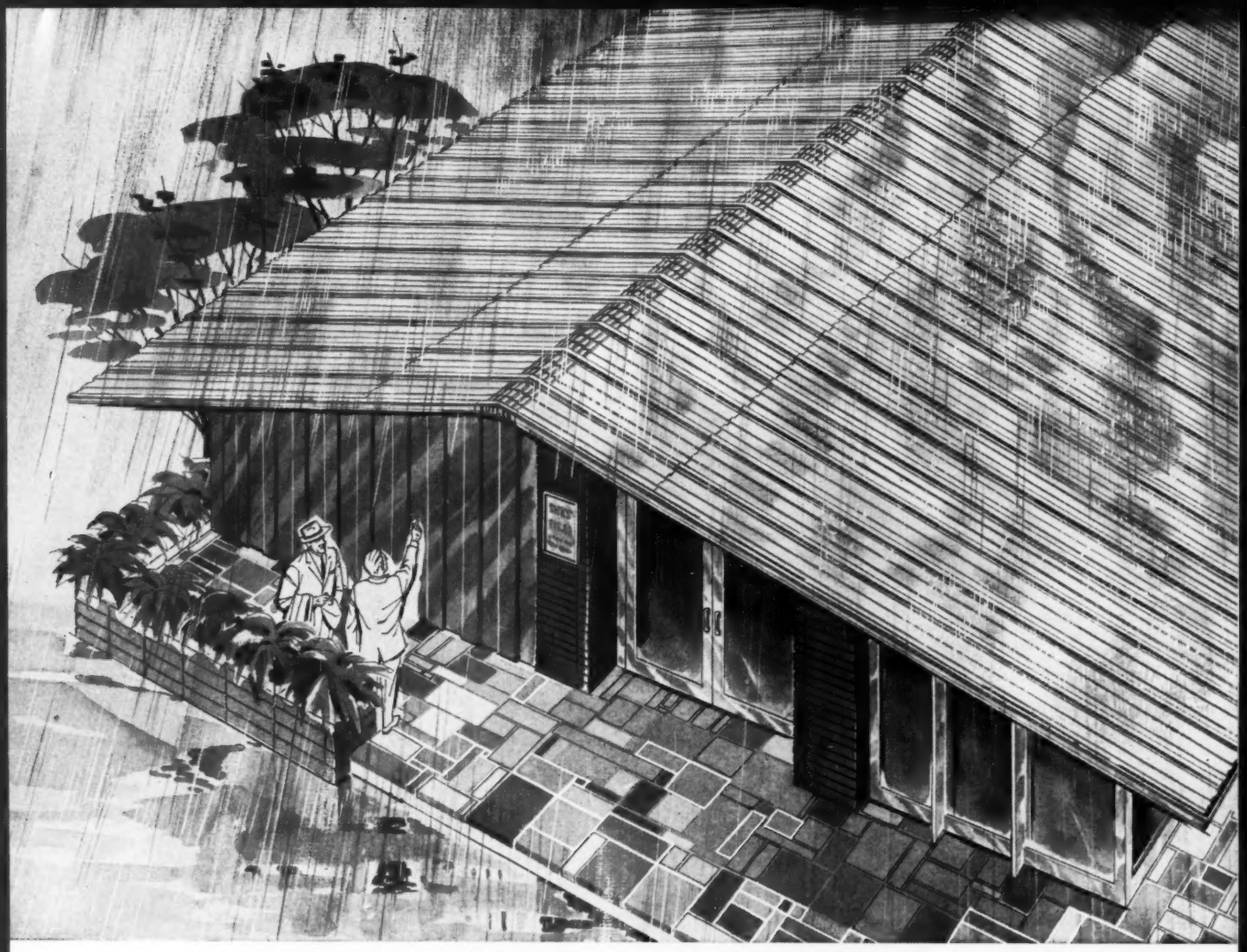

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New...and only with Butler... full 20-year roof protection for pre-engineered buildings

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For Engineers in Private Practice

Wayne near Pleasant Street
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AUGUST 1960 • VOLUME XV • NUMBER II

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Imaginative Engineering Puts to Work on *DAYLIGHT*

Mike Best and Ed Kralovec, mechanical engineers on the Madonna school, shown discussing job details with two of their colleagues.

Kralovec & Best, consulting engineers, went one step further in their heat and ventilation design for the new Madonna High School, Chicago — they applied pneumatic control to skylight louvers.

To meet the lighting requirements of the combination auditorium-gymnasium, architect C. I. Krajewski used a system of sky domes equipped with adjustable light dampers. How to control the dampers quickly and efficiently for change-over from plenty of daylight for gym activities to total blackout for movies, etc., was the problem presented to the consulting engineer.

Kralovec & Best's solution was — twenty-nine 4-inch powerstroke piston damper motors — one for each of

Sky domes, inside and out. Each contains a set of light dampers, all of which operate simultaneously when darkness for movie showings is desired in the combination auditorium-gymnasium.

Powers Pneumatic Control

MADONNA HIGH SCHOOL
Chicago, Ill.

Architect: C. I. Krajewski, Chicago
Consulting Engineers:
Kralovec & Best
Chicago
Heating Contractor:
Windsor Heating Co.
Chicago

the sky dome louvers on the roof — energized instantly from a single Powers pneumatic selector switch in the projection room. Turning the switch activates air pressure at 15 psi. through a Powers Series 500 Pilot Valve to the motors to close the light louvers. When the switch is turned off, pressure is released . . . and the louvers swing open to admit light.

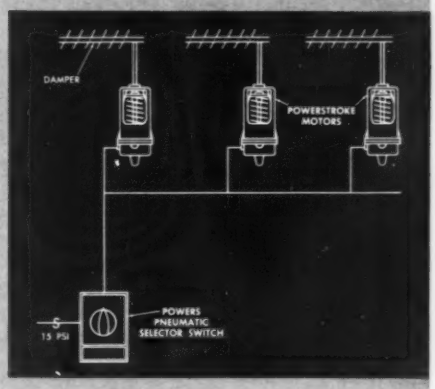
Pneumatic control of daylight in Madonna school is fast, easy and quiet — a definite convenience for the projectionist or instructors, an operational bargain for the school, maintenance-wise.

The complete heating system, as specified by Kralovec & Best, includes two hot water converters controlled at fixed temperatures. Individual classrooms are heated and ventilated by unit ventilators, controlled on the standard day-night cycle. Corridors, rest rooms, storage and locker rooms employ direct radiation controlled by Powers Day-Night room thermostats. For extra safety and comfort, hot water to all showers is controlled by means of a Powers Hydroguard Thermostatic Shower Control.

Here, then, is how imaginative engineering applied to pneumatic control can have unusual — but practical — results in an efficient, low cost system.

Write for the latest Powers Catalog of pneumatic controls for schools.

A single pneumatic selector switch in the projection room actuates 29 sets of light louvers through 29 individual powerstroke motors.



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MANUFACTURERS OF THERMOSTATIC CONTROLS SINCE 1891

A Portrait of the Profession

Consulting engineers have always had a hard time describing their profession or its function. In contrast to the sharp image of the architect, the public's picture of the consulting engineer is out of focus and, since he refuses to hold still, frequently blurred.

Governments, colleges, industries, and publications have tried to affix identifying labels on engineers. Schools award degrees in seemingly well defined branches of engineering – only to have their graduates promptly become prominent in some other field. Few engineers end up in those branches of engineering so boldly printed on their diplomas.

No one has had more trouble classifying engineers than magazines: both publishers and advertisers quite understandably would prefer a world populated by neatly labeled customers or prospects – an economy in which housewives buy all the soap, husbands buy all the razor blades, and mechanical engineers buy all the valves. Unfortunately, that is not the way it is. We have no figures on soap and razor blades; but we do know that a lot more valves are specified by consulting engineers who do not label themselves "Mechanical," than by those who do.

Pinning a label on any engineer and then using that label to identify his functions and activities is a frustrating endeavor. That is true for engineers as a whole, and it is most emphatically true for engineers in private practice, whose projects refuse to fit nicely into niches labeled "Electrical," "Structural," or "Mechanical." The consulting engineer must deal with all the parts that make up the whole. (See "The Editor's Tranquil Tower," page 32)

What an engineer calls himself is of little importance, we have found. What is important is what he can do. When a great bridge is to be built, the client should look for a man who has built, or has evidence that he can build, great bridges. That is much more sensible than looking for someone labeled "Bridge Engineer." The manufacturer of gaskets wants to reach the man who specifies gaskets, whether or not he has the unlikely title of "Gasket Engineer."

Functions identify engineering firms in private practice, not adjectives, titles, or restrictive labels. Accordingly, our new data form will identify your firm as to:

(1) the types of services offered (design, site selection, soil testing. . .)

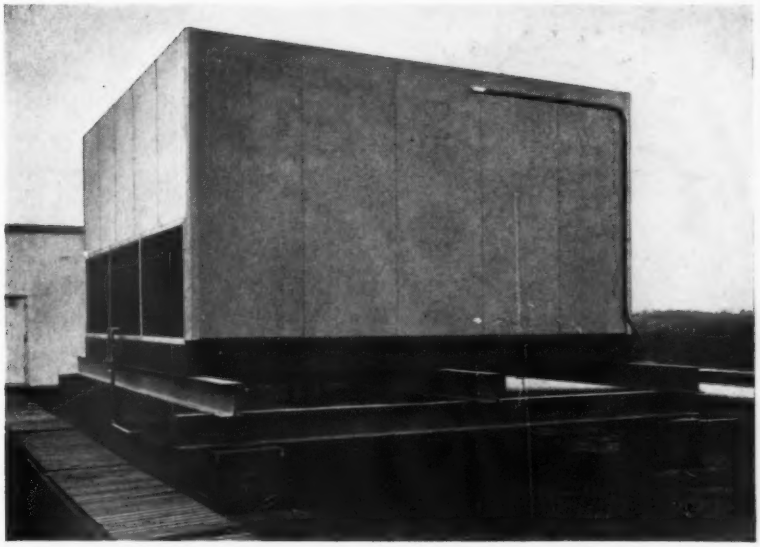
(2) The types of projects designed (airports, bridges, churches. . .)

(3) The types of materials and equipment specified (air conditioners, electrical apparatus, structural materials. . .)

Using this approach, we can identify with accuracy the functions of every engineering firm. We can, with our IBM cards and equipment, develop a good, clear, portrait of the consulting engineer. The more we know about consulting engineers (and this program tells us a lot), the more we can help them, their firms, and their associations properly identify the profession and its function and clearly establish its position in the world economy.

Russ Roe

Managing Director



NEW FROM CARRIER... FIRST MAJOR COOLING TOWER ADVANCE IN YEARS!

Lower operating weights—as much as 50% and more over conventional cooling towers.

Requires less floor space—about 25% less over-all base or floor area than other towers of same capacity.

More efficient and compact—with heat transfer efficiency maintained at a continuously high level and compactness that provides more freedom of tower site location.

The new Carrier all-steel Cooling Towers combine substantial savings in weight and floor space with a new standard of efficiency in operation. These important advantages are achieved by advanced Carrier design and the use of a new kind of lightweight, plastic fortified cellulose fill, which occupies just 1/5 the space of conventional wooden strips. Tested under the most severe conditions, this fill has stood up structurally and performance-wise.

Carrier Cooling Towers are now in use throughout the United States. They are available in 9 sizes with capacity range from 170 to 500 tons in a single cell. Larger tonnages can be handled with multiple cell towers. Besides savings in weight and space, they also offer lower installation costs and operating advantages. For details, write Machinery and Systems Division, Carrier Corporation, Syracuse 1, New York.

MORE PROOF OF
BETTER AIR CONDITIONING FOR EVERYBODY EVERYWHERE

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FULL-VALUE
CERTIFIED
TRANSFORMER
GENERAL ELECTRIC

- Superior design, features, and performance
- Faster shipment
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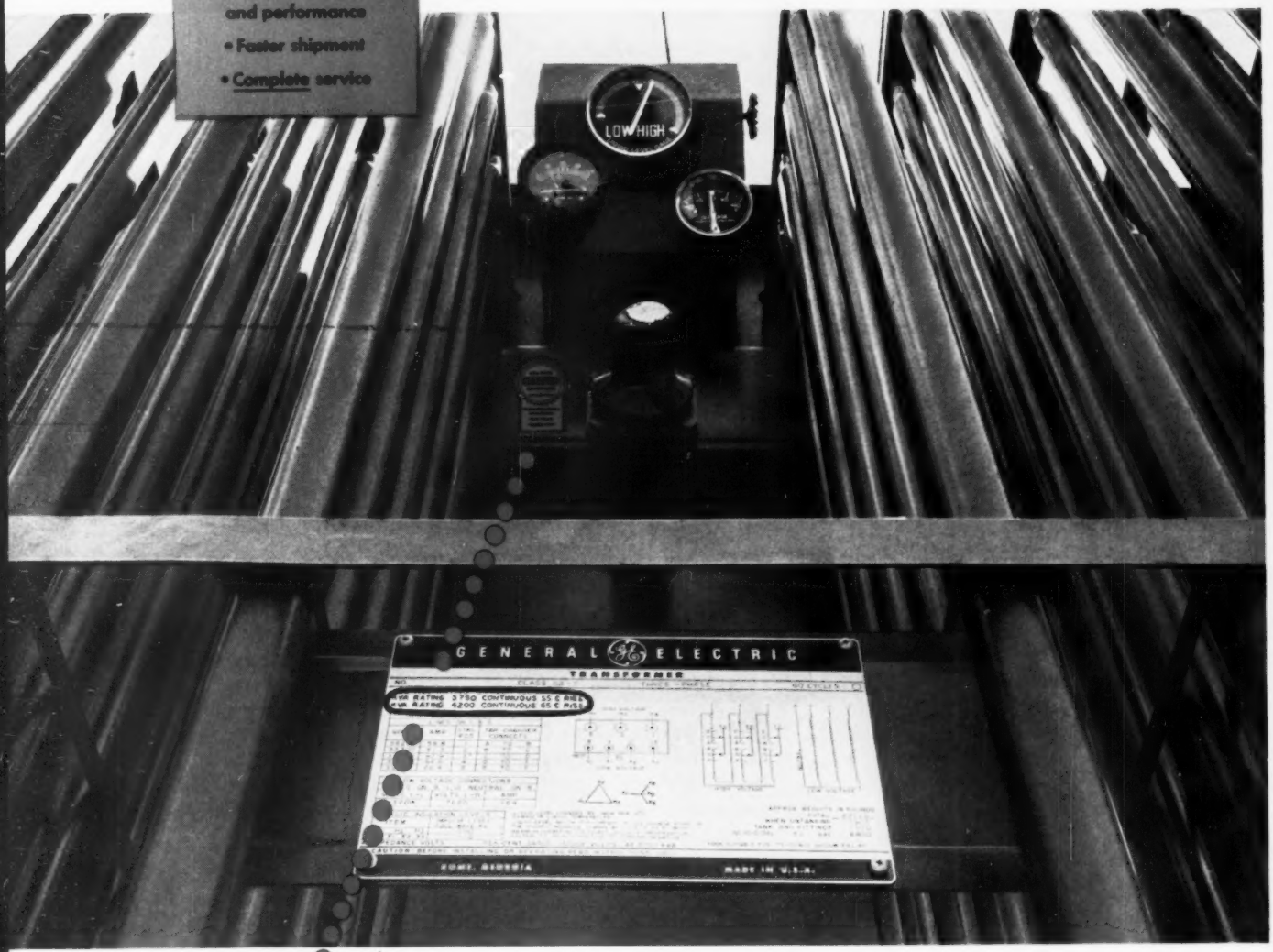
NOW 12% higher



SYMBOL OF FULL VALUE

With this seal, General Electric certifies full value for your transformer dollar; full value in terms of superior basic design, features, and performance . . . plus faster order handling and shipment . . . plus complete service before, during, and after installation. No other transformer manufacturer can match this complete General Electric package.

continuous loadability

General Electric's new Permalex* insulation system increases medium transformer continuous kva capability, or gives five times longer transformer life

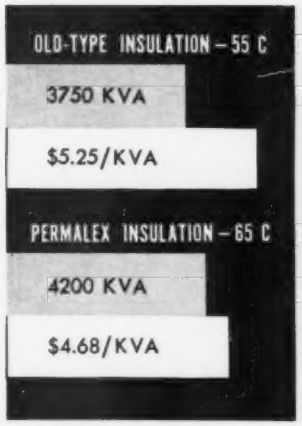
Now, as standard on all medium transformers**, and at *no extra price,* General Electric uses Permalex insulation . . . a system permitting transformers designed for 55 C rise to operate at 65 C rise with 12% more continuous capacity!

For example, a 3750-kva, 55 C transformer with Permalex will operate at **4200 kva,** 65 C rise with normal life expectancy. Or, if you prefer to operate the unit at 55 C, you can expect five times the life of present insulating systems! Fan-cooled rating increments remain the same and can be applied at the 65 C operating condition. Also, Permalex is *completely compatible* with everything in the transformer.

The Permalex system used in General Electric medium transformers features Formex† wire and cyanoethylated paper insulation. Formex insulated wire offers exceptional dielectric strength, outstanding thermal stability and high resistance to moisture effects. Cyanoethylation, which replaces many moisture producing molecules with non-moisture producing molecules, raises the thermal endurance of paper and retards the formation of water.

Ask your G-E Apparatus Sales Engineer to point out the many ways you save with Permalex insulated transformers . . . another result of General Electric's *continuing* Certified Full-value Transformer Program. General Electric Company, Schenectady 5, New York. 416-29

* Trade-mark of General Electric Company.
** 501 to 7500 kva, 69 kv and below.
† Reg. Trade-mark of General Electric Company.



PERMALEX INSULATION gives you extra kva at no additional transformer cost. The result is more economically uprated substations because of the lower cost per kva with no increase in transformer size.

55 C Self-Cooled	65 C Self-Cooled	65 C Fan-Cooled
750 kva	840 kva	966 kva
1000	1120	1288
1500	1680	1932
2000	2240	2576
2500	2800	3500
3750	4200	5250
5000	5600	7000
7500	8400	10500

DEFERRED CHANGEOUT of added kva gives more years of operation without extra investment. Real evaluation of Permalex is measured by present worth of capitalized value of deferred investment.

FORMEX TURN INSULATION with cyanoethylated paper insulation provides high dielectric strength, outstanding resistance to moisture and much longer life for medium transformers.

Progress Is Our Most Important Product

GENERAL ELECTRIC

"'K&M' ASBESTOS-CEMENT

LAYS AS FAST AS

Assembling 16" "K&M" Asbestos-Cement Pressure Pipe by hand without the aid of a bar. The backhoe merely steadies and aligns the pipe. The easy, two-step operation consists of (1) lubricating the tapered end of the pipe, and (2) sliding pipe into coupling.

PRESSURE PIPE

A SHOVEL DIGS..."

G&B Construction, Inc., Youngstown, Ohio, installs 4½ miles of "K&M" Asbestos-Cement Pressure Pipe for the Austintown District of Mahoning County, Ohio

"You can lay 'K&M' Pipe as fast as a shovel can dig. There is nothing that will hold you back with this pipe. When you can lay a 16" water line, and it goes in as easy as an 8" water line, what more could you ask? They've got a good joint with that FLUID-TITE® Coupling . . . the pipe is wonderful to put together. There is no comparison between the FLUID-TITE Coupling and other couplings. Of all the 'K&M' Pipe we've laid, we never had a coupling break. Coupling breaks are very common with other pipe."

Those are the comments of Louis Gulfo, partner with Mike and James Bertilacci in G&B Construction, Inc. They installed "K&M" Asbestos-Cement Pressure Pipe in bitter cold, during February and March 1960. However, neither rain, snow, nor mud interrupts the installation of this modern pipe. The exclusive, patented "K&M" FLUID-TITE Coupling and the simple fitting procedures required make assembly easy.

Little or no maintenance will face Mahoning County, which built and will operate the system for a year, or the City of Youngstown, Ohio, which will then take it over. Being non-metallic, "K&M" Asbestos-Cement Pressure Pipe won't rot, corrode, or tuberculate, and is immune to electrolysis. The suppliers of this pipe were Trumbull Plumbing Supply Co., Warren and Youngstown, Ohio.

Now, in addition, you may use quality "K&M" Plastic Pressure Pipe in the same system with "K&M" Asbestos-Cement Pipe, if desired.

Write today for more information on "K&M" Asbestos-Cement Pressure Pipe to: Keasbey & Mattison Company, Ambler, Penna. Dept. P-1280.

K·M
BEST IN ASBESTOS

Keasbey & Mattison at Ambler

Left to right: Louis Gulfo, G&B Construction, Inc.; Dale MacCleary, sales manager, Trumbull Plumbing Supply Co.; James Bertilacci, G&B Construction, Inc., Burke Lyden, Asst. Chief Engineer, Youngstown, Water Dept., Jim Bisciglia, Asst. Engineer, Mahoning County, and J. Henry Painter, Trumbull Supply Company.

3 miles of 16" "K&M" Asbestos-Cement Pressure Pipe were installed. Here, we see it ready for installation along Webb Road, in Austintown Township. In branching from the 16" water line, Mahoning County used 1 mile of 12" "K&M" Asbestos-Cement Pressure Pipe and ½ mile of 8" "K&M" Asbestos-Cement Pressure Pipe. Specifications call for 90 lbs. pressure when line is in operation serving 16,000 residents.

Roland R. Duquette

– Starts on front cover

The Association was organized in 1925, and the bylaws allow the establishment of local chapters, but each has been permitted to set up its own rules. This summer, the ACEC board will approve recommended chapter bylaws to make the chapters more uniform.

Even more important, in Duquette's opinion, than uniformity, is the establishment of new chapters. "The chapters are established on the basis of districts. We think potential membership is a better guide for chapter formation than provincial boundaries. More chapters were necessitated by increased ACEC membership, and we feel that local chapters will result in increased interest in ACEC on the part of the membership, thereby automatically resulting in membership increases."

Cooperation is Important

Duquette has made better liaison with other organizations the next aim for his term as president.

"Hueston Smith, president of the Consulting Engineers Council, called me last spring about the possibility of holding a joint meeting between the executive committees of ACEC and CEC. I think this is an execellent idea, and I hope the details will be worked out within a few weeks. A joint meeting of these two groups, which share so many problems and interests, should become an annual occurrence – maybe even semiannual. Although the initial joint meeting will be held soon, I think the best future meeting date would be in the spring. This way, the two executive boards could talk things over before their respective annual meetings. An added advantage would be that the joint meeting would precede the annual meeting of FIDIC, a group of great importance to both American groups."

Duquette also wants to see better liaison between ACEC and other Canadian engineering organizations. "All ACEC members belong to other Canadian engineering societies, so if these dual members would become active in both their organizations, liaison would be automatic, and I think the entire profession would benefit."

Another area in which Duquette is urging discussion among ACEC members is advertising of professional services. This has been restricted by ACEC rules, but recently several Canadian consultants purchased professional listings that were large enough to pass for display ads.

"I think we all have to face the fact that consulting engineering is a business in competition with other businesses and, in some instances, with government agencies. If advertising is a way to reach prospective clients, perhaps ACEC should seek to control it instead of ignoring its existence. We could see that the advertising was done in a professional manner, with no exaggerations or misstatements of fact. At least I would like to see the subject receive intelligent discussion instead of being buried in the Code of Ethics."

At the ACEC meeting last spring, a primary matter of interest was the interpretation of the membership qualifications. ACEC held discussions typical of all consulting engineering groups – should young consultants be brought into the association earlier, or should ACEC maintain its relatively stringent restrictions? Duquette approved the decision to leave things as they are – a 35-year minimum age with five years (or equivalent) experience as a consulting engineer.

"One of the functions of the Association is to give clients confidence – the feeling that they are dealing with professionals who are well established as consultants – men who will still be around in five or ten years should their services be required again. When a man is under 35, he may not know whether he wants to be in the profession for good."

Duquette also wants to see the Association's *Newsletter* improved so that it becomes a mirror of the members' ideas. "As a public group, we should face our problems rather than function as a mutual admiration society," he added. He put this into practice by first publishing his ideas on professional advertising in an article presented in the July *Newsletter*.

Fee schedules also are coming up for discussion in Canada. Most of the provinces are revising current schedules. Also, the newly formed consultants committee of the Canadian Council of Professional Engineers is working on a schedule. For the present, ACEC is waiting to see what happens.

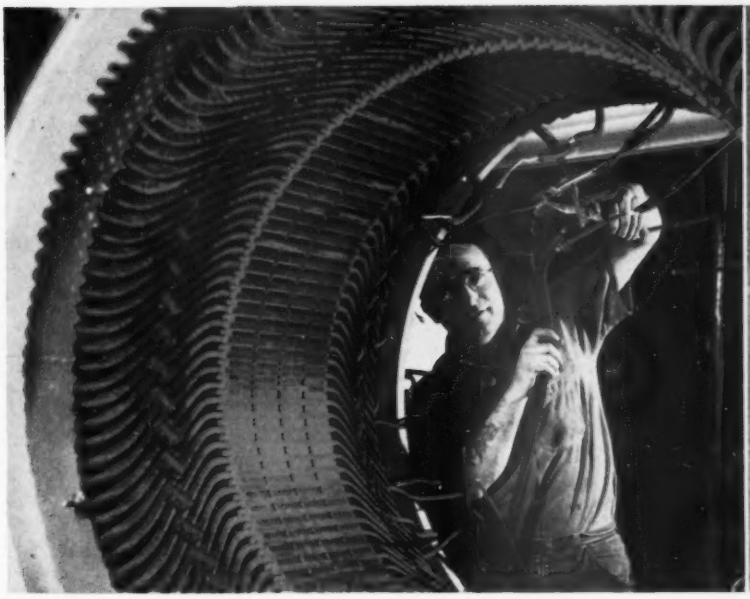
The ACEC president also thinks a manual of practice is needed by his group. In the past, the Canadians always have had fee schedules, but never anything to tell the client what to expect for those fees.

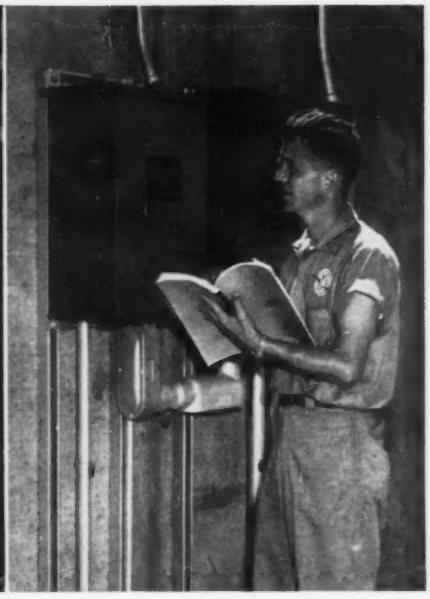
Asked if Quebec, with its mandatory minimum fee written into the law, is the solution to all fee problems, Duquette said, "Not necessarily. About the only time a consultant would have to call for legal enforcement of the fee schedule would be when he was working on the basis of a verbal agreement with an owner who later refused to pay. No judge would be likely to award more than a minimum fee in such a case, regardless of the complexity of the job. Besides, not many consultants work without written contracts these days."

Duquette is the son of a contractor and a descendant of six generations of Canadians. "My ancestors were among the first settlers in what is now

SILICONE NEWS from Dow Corning

The Current Revolution





Silicone Insulated Equipment Brings Economy, Flexibility

Chances are you've heard of the current revolution in electrical equipment . . . of outdoor motors stripped of weatherproof housings . . . of motors that laugh at overloads . . . of smaller, lightweight transformers that put power right where you want it.

These developments typify three phases of today's growing trend toward electrical equipment that's more reliable and easier to install . . . less expensive initially and in the long run.

Phase I — Self-Protecting Insulation Cuts Motor Costs

Motors need no costly enclosures . . even outdoors . . . when they've got self-protecting insulation systems. The insulation system itself, when made with Silastic®, the Dow Corning silicone rubber, shrugs off weather, humidity, corrosion . . . is no longer the "weak-link" to be coddled. Result: There's no need for the elaborate enclosures that push motor prices out of sight. Open motors do the job — costs are cut as much as 50%! Proof: One firm saved $28,000 on only three motors by specifying silicone insulated open motors rather than totally-enclosed fan-cooled units.

Phase II — Increased Service Factor Motors Reduce Power Costs

Motors with insulation systems that don't get "burned-up" when asked to carry overloads . . . that's one way of describing motors built with Dow Corning Silicones for extra service factor. When the going gets rough and production schedules are critical, they carry overloads of twenty-five to fifty percent beyond nominal rating . . . without distressing smoke signals. And though they deliver more horsepower when needed, they're still no bigger than their conventional counterparts . . . have the same nameplate horsepower rating. Result: You specify motors to match load, let silicones carry the overloads. No need for larger, more expensive motors just to handle occasional overloads . . . and you gain in reliability, too.

Phase III — Silicone Insulated Transformers Give Power Where You Want It . . . At Less Expense

New dry-type transformers insulated with silicones contain no toxic or flammable liquids. They're smaller, lighter . . . don't require expensive vaults or barriers. Result: Silicone insulated transformers are easier to handle, easier to install, can be located right at load or load center, need almost no maintenance. They save on costly low-voltage cable, too. You get greater flexibility of the distribution system and cut costs at the same time.

KEEP PACE WITH THE BIG CHANGE

Send today for the booklet, "Specify Silicone Insulated Motors and Transformers and Save", and get the full story on the current revolution in electrical equipment. Address Dept. 230C.

SPECIFY Dow Corning Silicones and **SAVE!**

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

Safer because it's Simpler

■ Of all boiler water level controls, we believe Magnetrol to be the safest. Certainly it is the simplest.

A PERMANENT Alnico magnet, located *outside* the float chamber, links boiler water level and electrical controls. This infallible magnetic link eliminates mechanical parts normally subject to wear and fatigue failure. *Pioneered and perfected by Magnetrol,* it provides almost unlimited operating life.

The brass "No-Scale" float chamber liner, another exclusive Magnetrol feature, is self-cleaning. It actually "flexes" off scale and prevents "sticking" of the float.

A magnetic sleeve, raised and lowered within a non-magnetic tube, "trips" or releases an Alnico permanent magnet attached to a mercury switch. Basically, this is Magnetrol.

These are just two of *many* advances for greater boiler safety found *only* in Magnetrol. *Standard* Magnetrol units are available for temperatures up to 750°F., at pressures up to 600 psi, for single stage (low water cutoff) or multi-level stage (pump control *plus* low water cutoff and alarm) service with as many as three separate switching actions. Special units are available for more extreme requirements.

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Gentlemen: Please send me Catalog Section III and full information on Magnetrol Boiler Water Level Controls.

9

Name_____

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a suburb of Montreal. They were involved in the battle between the French and the English. Matter of fact, one of my great-grandfathers was captured and hanged near here in 1837."

Professional Background

For as long as he can remember, Duquette wanted to be an engineer. He was graduated from Ecole Polytechnique, in Montreal, in 1932. "I took a general engineering course, because at that time most colleges did not have specialized programs for a mere five year degree course. I am beginning to wonder if that general course was not the best plan. Today, a boy is asked to choose his specialty when he is a sophomore in college, and at this point he does not know enough about engineering to make an intelligent decision."

Duquette, like many other engineers, had his career shaped by the depression and the war. "I wanted work in the summers to gain experience and pocket money. I never will forget my first job interview. All my prospective employer wanted to hear about was my experience. I told him that unless he hired me, I might never get any experience because I could not find a job. I even offered to let him decide what to pay me after I had worked for a month. My approach must have appealed to him because he told me to report for work the next morning."

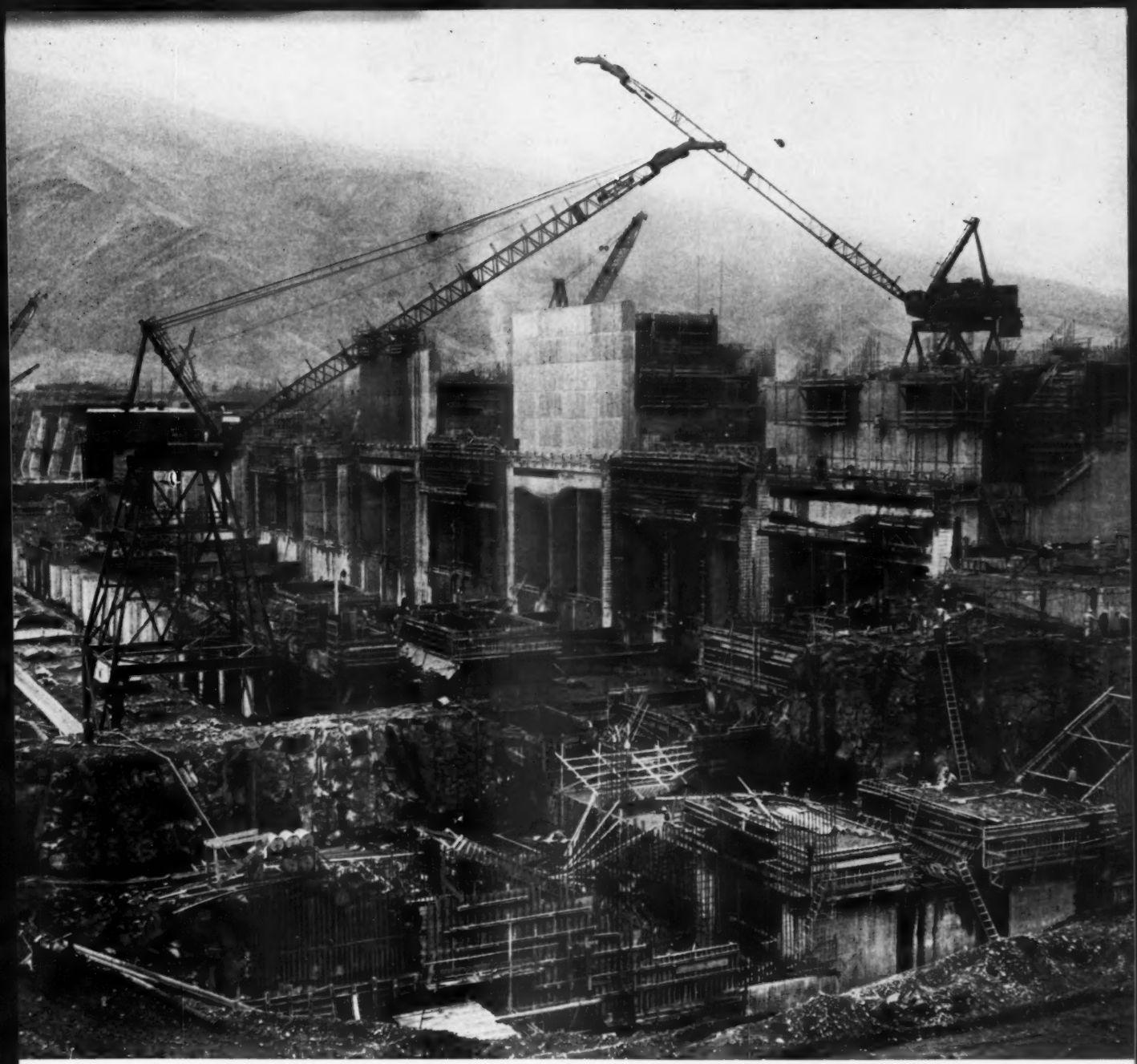
Upon graduation, only two or three boys in the class had jobs promised. Duquette first began work as an assistant professor teaching lab classes in the school's new hydraulics laboratory. Then one of his former teachers, who also was a consultant, hired him as a draftsman and he went to work for Villeneuve, Bernier & Leblanc, in Montreal.

The next year, Duquette was offered a job as a designer – and later became a partner – in the firm of Ricard & Royer, Quebec City. Upon getting this job, he married the girl he had been courting for six years. "In those days, money was too scarce for very frequent dating, and no one even considered marriage before graduation."

In his new job, Duquette did drafting, designing, and a little bit of everything else, including the typing of his own specifications.

A year later, Richard became ill, and the partnership was dissolved. Duquette went into business with an acquaintance to form the firm of DeGuise & Duquette. "We had no projects and no job offers, so we decided to pool our lack." Soon the two were doing mechanical and electrical design on schools, churches, and similar projects – the same type of work Duquette always had been doing.

When Canada entered the War, all projects except war work stopped, and Duquette and DeGuise agreed to take any individual opportunities that



AMERICANS ARE PROJECT PROVEN

Around the world, consulting engineers prefer project proven American equipment that meets their most rigid requirements. Heavy-duty Revolver Cranes (above) have helped build the biggest dams in the world—worked 24 hours a day for years with the dependability that's essential on such jobs. More than three-quarters of a century of "Big-Job" efficiency and experience are built into every American.

For custom built gantry and bridge cranes, derricks and hoists, contact our Engineered Products Division. Its drawing board to construction services are available to consulting engineers concerned with the design of unique and specialized materials handling equipment. Write for specific facts on the complete American line—machines for every job, from excavation to erection to maintenance

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Extra Strong! Exclusive swaging and forming process prevents cross bars from turning, twisting, coming loose or falling out . . . provides greater strength and rigidity than gratings using obsolete methods of joining bars. Non-rusting and corrosion-resistant . . . ideal where chemical conditions prevail.

Lighter Weight! High strength to weight ratio. Minimum deflection . . . easier to install.

Better Looking! Can be used for decorative purposes, sun shades, grilles, etc. Can be anodized in sunfast colors to blend with surroundings.

Available with serrated or plain bars—in all sizes to meet practically every requirement.

Write for Bulletin C14R

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*Patent Pending

ROCKWELL-STANDARD CORPORATION

Grating Division, Gary, Indiana

came along. Not long afterward, McDougall & Friedman, one of Montreal's oldest mechanical-electrical consulting firms, offered Duquette a "temporary" job – as resident engineer on an arsenal project near Quebec City.

"I did not think the 'temporary' job would last more than six months, so I left my family in Montreal. The project took four years. Of course, we did not expect the war to last that long."

The arsenal was one of the most interesting and difficult projects on which Duquette ever worked. Designs had to be prepared fast enough to keep 200 plumbers and about 150 electricians busy. Equipment was difficult to get, so the engineers had to work with Canadian, U. S., and strangely, German material (via Switzerland). Since they never knew what they would get next, the designers had to wait until one piece of machinery arrived, study it, then design the entire line before the remainder of the order came. Later, the arsenal buildings were sold for a nominal sum to Quebec City and turned into an industrial center.

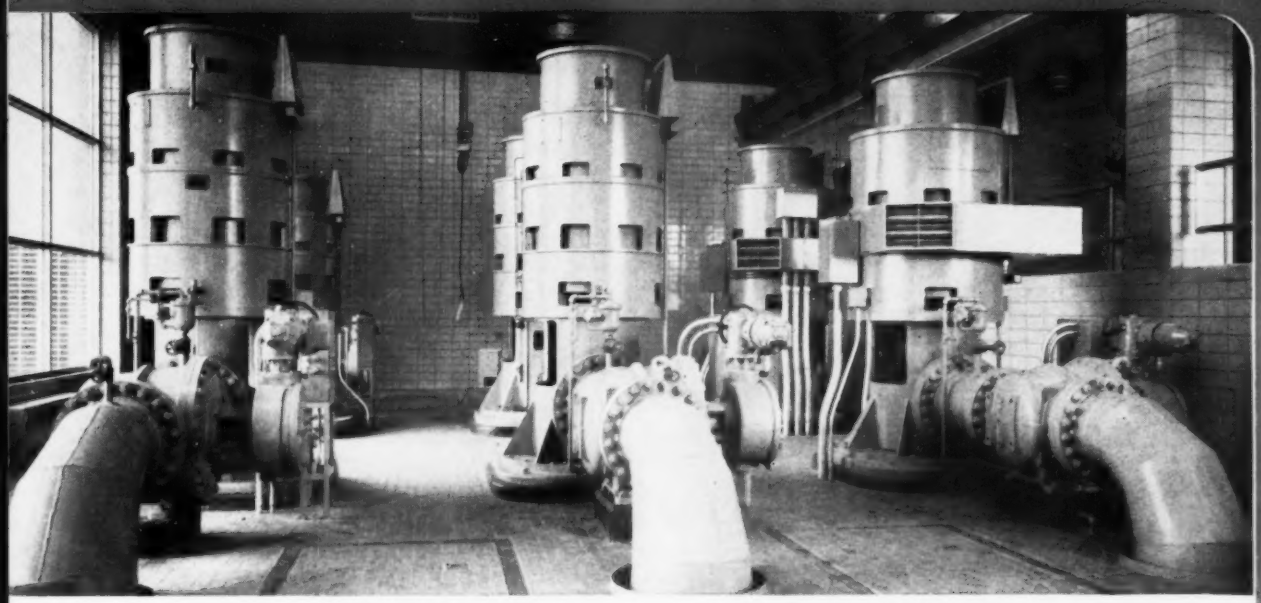
Engineering Specialties

Duquette always had a secret ambition to be a structural engineer, but circumstances had turned him into a specialist in mechanical and electrical design. After the War, he considered starting back on the board as a structural designer. However, he decided the grass probably would always look greener in another specialty, and he now is glad of his decision to stay in mechanical-electrical.

"When I first started, the mechanical-electrical phase of a project seldom totaled 15 percent of the total building cost. A $1 million building was a big project and M-E services were at a minimum. Now the mechanical-electrical is about 40 percent of the total construction cost, and we have $10 million in just M-E on our boards right now."

Although McDougall & Friedman do mechanical-electrical design for all types of projects, hospitals are Duquette's personal specialty. The firm currently has 14 hospital clients. One of the larger projects recently completed was the Montreal General Hospital. On another hospital project, McDougall & Friedman did the original hospital design in 1929. The firm still is working from the 30-year-old master plan. "Most of our clients have been with us for years," Duquette pointed out.

McDougall & Friedman is one firm that has no trouble dealing with architects. Whether the firm is selected on a job by the owner or the architect, in most instances the owner pays McDougall & Friedman direct. Other Montreal consultants are envious of McDougall & Friedman's policy. "We have been fortunate to establish good relations with our clients, whether owners or architects. I hope



PLENTY OF WATER for Springfield-66 MILLION GPD Max.

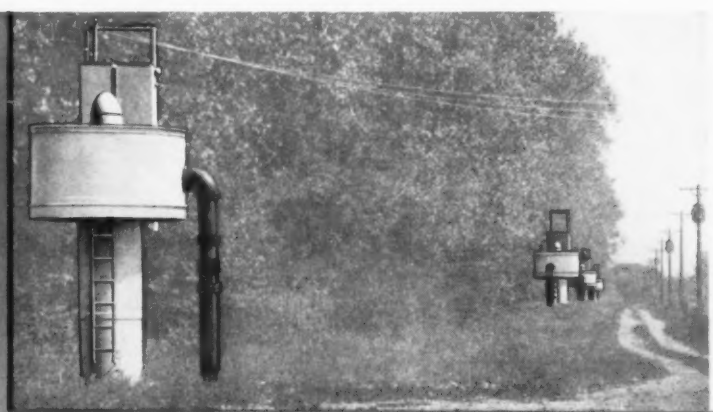
Springfield, Ohio has a completely new, automatic water supply system by Layne. It guarantees 66 million gallons per day for their present and future needs—a job complete by Layne—and a completely satisfied customer. Field Tests exceeded the guaranteed pump efficiencies by 1% to 2% on all units. Consulting Engineers: Black and Veatch, Kansas City Missouri. Water Supply Contractors: The Layne Ohio Company, Columbus, Ohio. Do you need complete water service? Get it from Layne. Write for Bulletin 100.

Specifications

RAW WATER—10 Layne Gravel Wall Wells with Layne 18-8 Stainless Steel shutter screen and 10 Layne deep well pumps. 2800 GPM — 65 ft. TDH, 75 hp—440 Volts— 1750 RPM, located in two banks pumping to the filter beds. Pumps were installed 15 feet above ground level for flood protection.

FILTERED WATER—Six Layne high service pumps boosting filtered water into distribution system. Five are 12 MGD-285 ft. TDH, 700 hp—4160 volts—1185 RPM. Two are variable speed units. The sixth Layne Pump is a 6 MGD-285 ft. TDH, 400 hp—4160 volts—1185 RPM. All pumps operate through the central control panel.

LAYNE OFFERS COMPLETE WATER SERVICE: Initial Surveys • explorations • recommendations • site selection foundation and soil-sampling • well drilling • well casing and screen • pump design, manufacture and installation construction of water systems • maintenance and service • chemical treatment of water wells • water treatment—all backed by Layne Research. *Layne services do not replace, but coordinate with the services of consulting, plant and city engineers.*



Layne SINCE 1882 — WORLD'S LARGEST WATER DEVELOPERS

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LAYNE ASSOCIATE COMPANIES

THROUGHOUT THE WORLD

Sales Representatives in Major Cities

CASE HISTORY

City of Springfield, Ohio

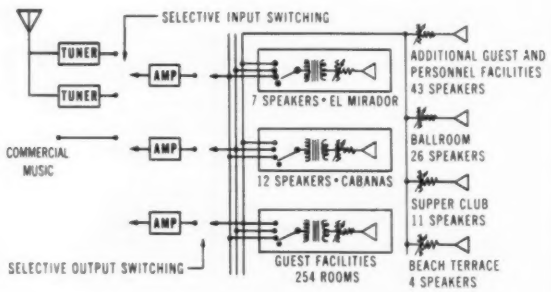
Hotel "La Concha" Sound Engineer* specified ALTEC

12-65

In the new luxury Hotel "La Concha" in San Juan, Puerto Rico; in Detroit's ultra-modern Ford Memorial Auditorium; in the International Amphitheater in Chicago; in stadiums, schools, hospitals, churches, shopping centers; in government, commercial and industrial buildings all over the world—you'll find ALTEC Engineered Sound Products.

That's because ALTEC sound systems, like all ALTEC products, are designed for dependable service under all conditions, for long life, and for ease of installation and service.

And it's because of the hundreds of ALTEC engineer-consultant-contractors who are ready to serve you with more than 100 different ALTEC commercial sound components and/or systems designed to your specifications. Before you specify commercial sound equipment, you'll want to talk to your nearest ALTEC contractor. For his address look in the Yellow pages of your Telephone Directory or write to ALTEC at the address below.



The entire sound system of the luxurious Hotel "La Concha" in San Juan, Puerto Rico is designed around a complete line of Altec commercial sound equipment.

*McKee Electric Inc., Mt. Vernon, New York
Sole Electric Inc., Puerto Rico

ALTEC LANSING CORPORATION, Dept. CE-8D
1515 S. Manchester Avenue, Anaheim, Calif.
161 Sixth Avenue, New York 13, N. Y.
A SUBSIDIARY OF LING-ALTEC ELECTRONICS, INC.

to see the day when all consultants will demand and receive the same treatment," Duquette added.

The Montreal firm has other unusual business policies. They have 25 to 30 employees — almost all engineers. "We believe engineers should do their own drafting unless they are in charge of a department and do not have the time. It is almost as quick to do the drafting as to give a draftsman the proper supervision. Also, it is during drafting that an engineer gets a thorough knowledge of project details. We find this eliminates many errors and extras."

Several years ago, McDougall & Friedman tried a profit sharing plan, but dropped it. "We might have a busy year, but not have too much cash on hand. The next year we might not be doing too much but still receive fees from previous jobs. We found that in our business, profits can vary considerably from year to year. To be fair, profits should be averaged over three or four years. Yet employees getting a big bonus one year would be dissatisfied if they did not get the same the next year. So we just pay more week by week and forget the profit sharing."

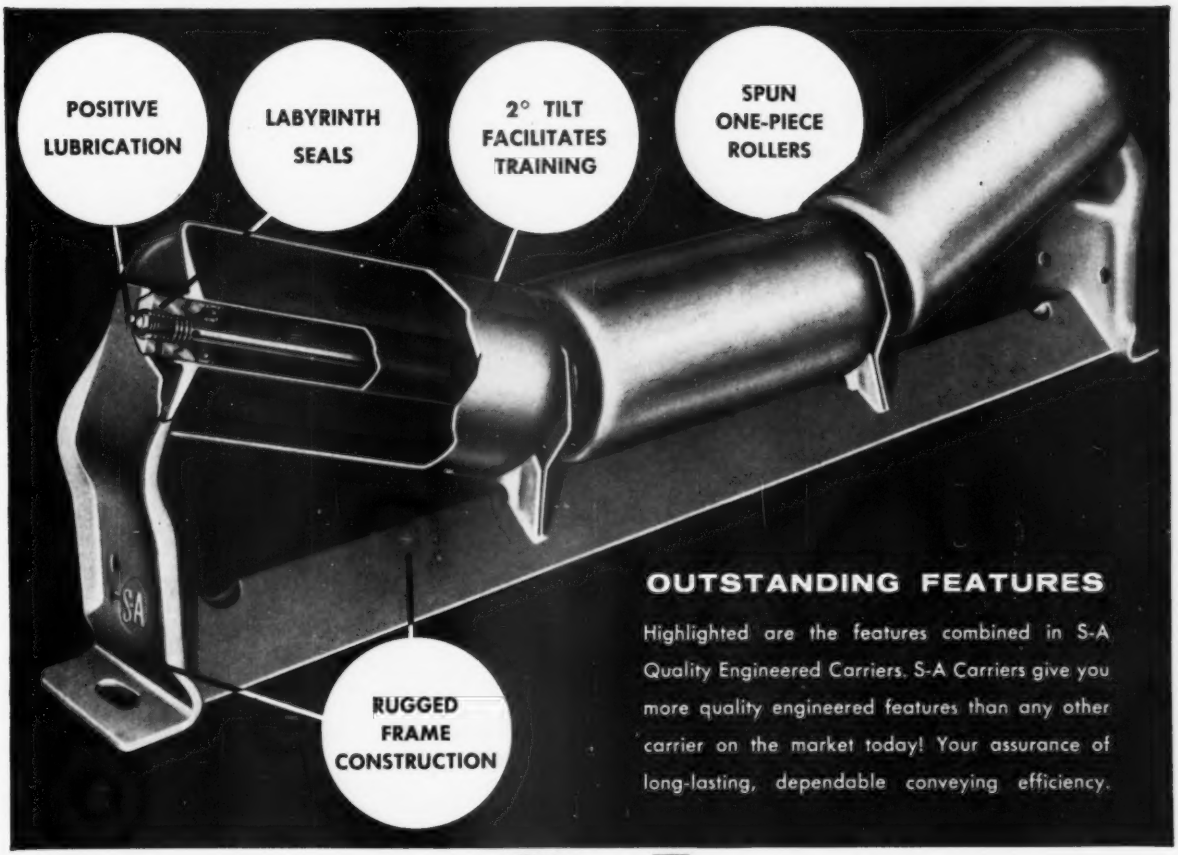
What do Canadian consultants think of U. S. engineers practicing in Canada? "In Quebec, we welcome any engineer who wants to establish a practice. The ones who are resented are the consultants who open an office with one man in it, then do the engineering elsewhere. We do not consider this to be practicing engineering in Canada."

How have the Canadian consulting engineers attained their enviable recognition from their government? "About 15 years ago, the Minister of Commerce was a man who had been a prominent consulting engineer before he went into politics. He established the policy of promoting Canadian engineering as well as other Canadian businesses and professions abroad. This has worked out very well. A representative of the Department of Commerce often attends our meetings, and he is well acquainted with our group. On World Bank projects English and German engineers seem to be turning up everywhere, and our government would like to see us get our share of these projects."

Has McDougall & Friedman done any foreign work? "We once had an office in New York City, because that was Friedman's home before he decided to move to Montreal. But we have done nothing outside of Canada since the War."

ACEC, like the Consulting Engineers Council in the United States, has a problem with engineering being handled by government employees. This, as well as many other similar problems, makes the need for closer U. S.-Canada relations an important item on Duquette's ambitious agenda for ACEC. ▲▲

MORE PROFIT PER TON FOR YEARS TO COME!



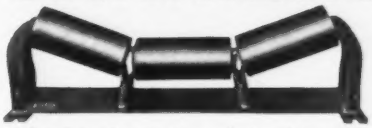
OUTSTANDING FEATURES

Highlighted are the features combined in S-A Quality Engineered Carriers. S-A Carriers give you more quality engineered features than any other carrier on the market today! Your assurance of long-lasting, dependable conveying efficiency.

STEPHENS-ADAMSON

Quality Engineered CARRIERS

Maximum conveying efficiency and profitable bulk handling over the belt depends on what's under the belt in quality-engineered conveyor components. No single component has a greater bearing on conveyor performance than the carriers, carrying the load. The combination of features you see highlighted in the cutaway view above, are available in no other carrier on the market. The result is smooth performance, simplified and reduced maintenance, longer carrier life and less handling cost per ton. STEPHENS-ADAMSON Carriers are available in a wide range of sizes in both ball and roller bearing carriers . . . stocked for immediate delivery.



20° Ball Bearing Carriers—designed for years of service under rugged operating conditions.

Rubber Disc or Pneumatic "Impact" Carriers for use under loading spouts in belt or shuttle conveyors, or feeders to cushion the lumps.

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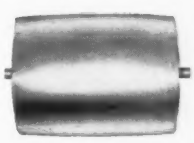

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Reporting more news from . . .

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. . . a fast-moving program of planned expansion, product development, and streamlined distribution to help our customers meet the competitive challenges of the Sixties.

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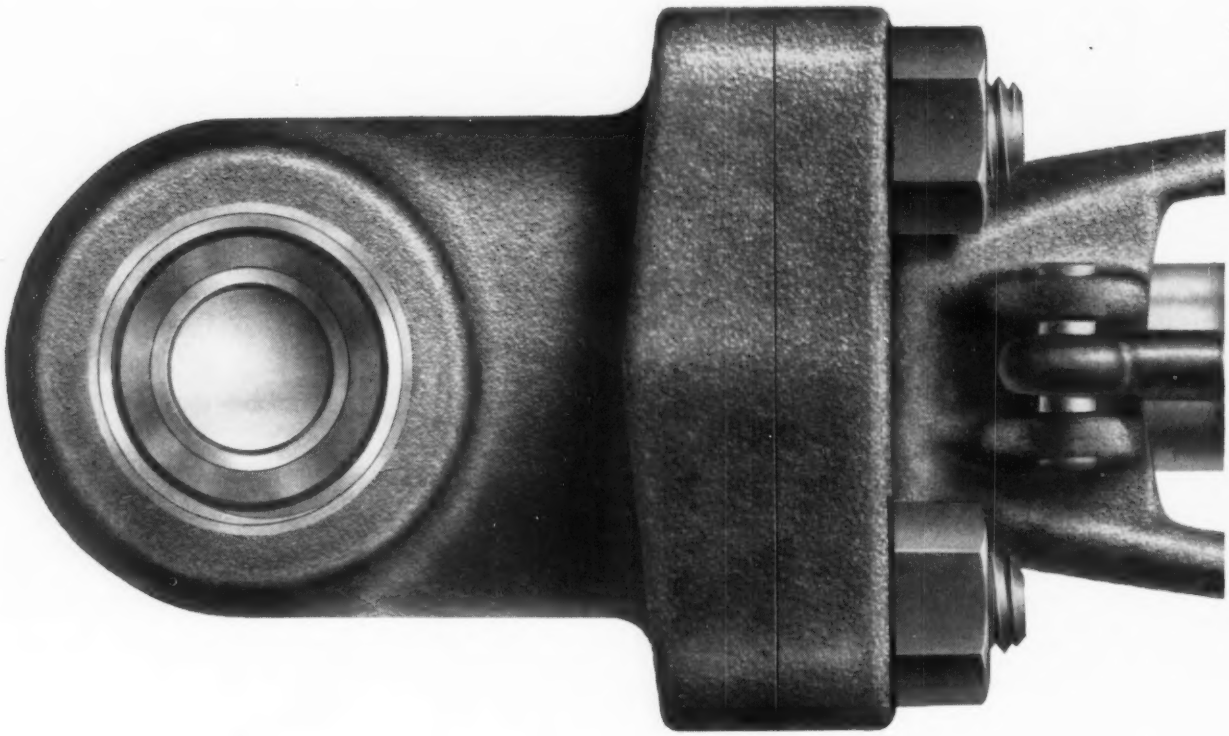
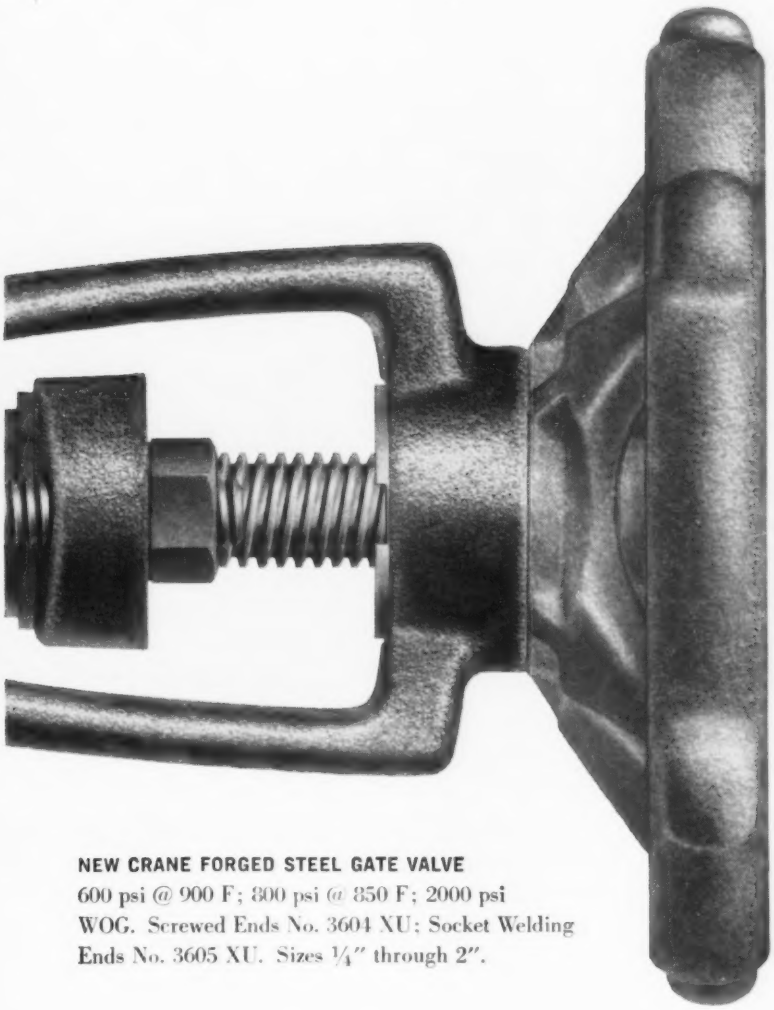


REDESIGNED!

THE NEW SMALL FORGED STEEL GATE VALVE



NEW CRANE FORGED STEEL GATE VALVE
600 psi @ 900 F; 800 psi @ 850 F; 2000 psi WOG. Screwed Ends No. 3604 XU; Socket Welding Ends No. 3605 XU. Sizes ¼" through 2".

This is a whole new valve, not just one with a new feature added. This redesign incorporates all the features you told us you wanted plus a few others we know will make this valve a better buy in terms of longer service life, less maintenance, easier and faster servicing.

Like the new "bow-leg" yoke, which for the first time gives you plenty of hand room for easy stuffing box maintenance. And like the long-life braided asbestos packing, with Inconel wire insert. The "universal" trim that can be used for either oil or steam, eliminating many of your stocking problems. The spiral wound stainless steel bonnet gasket with asbestos filler, made blowout-proof with a male-female joint.

But what we really want you to remember, more than any single feature, is that this Crane valve is the newest—all new—valve on the market . . . well worth considering when you need small, high-pressure steel gate valves. We'd like you to compare this new valve with any other comparable valve feature for feature.

Your local Crane distributor has technical literature and a complete selection of these valves right in stock. Call him on small steel gates. In fact, he's your best bet to call no matter what valve you want because he carries the broadest line of quality valves in the world.

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VALVES • ELECTRONIC CONTROLS • PIPING
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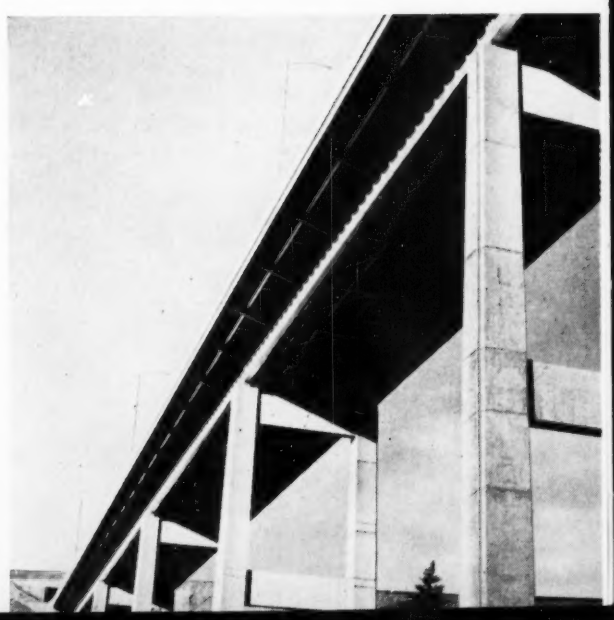
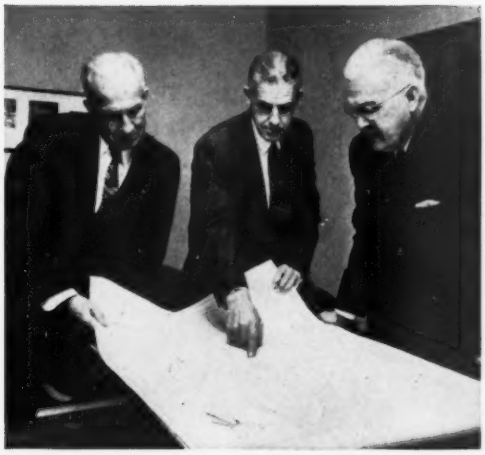
New Maple Street Bridge, Spokane, Washington, designed in steel for economy and fast erection.



Underside of Maple Street Bridge showing built-up steel members. Steel can be readily welded, flame-cut, riveted or bolted.

This mark tells you a product is made of modern, dependable Steel.



Admiral Carl A. Trexel, Vice-President, Leslie A. Helgesson, Vice-President, and Ralph A. Tudor, President, discussing plans for a steel bridge.

Steel specified in 80% of bridge work

at Tudor Engineering Company, Consulting Engineers, San Francisco

Some of the recent outstanding bridges this firm has designed include the Dalles and Umatilla Bridges across the Columbia River in Oregon; the Maple Street Toll Bridge over the Spokane River at Spokane, Washington; and another toll bridge which spans the Port Washington Narrows at Bremerton, Washington.

Of these, the Maple Street Bridge is the most outstanding example of the use of structural steel in short-span bridge design to gain the advantages of economy and rapid construction. The bridge is 1,713 feet long and is built of steel with four 150-foot spans, two 125-foot sections and five 100-foot sections. It supports four roadways.

Steel reduces costs. According to Mr. Ralph A. Tudor, President of Tudor Engineering Company, steel construction offered a great advantage for this bridge because a crew could swing a section into place, bolt it to the supports, and then move ahead to the next section. No falsework was involved, the erection was fast, clean and safe, and the design was the most economical solution.

Steel saves design time. Steel is a familiar material and there are no unknown factors. This is important because the designer is looking for reliable performance. The new electronic calculators can be used to work out mathematical problems quickly in steel bridge design.

Steel permits increased headroom. New highway regulations are calling for increased headroom and this can be obtained most economically with steel. Bridges can be designed with higher strength steel, such as USS MAN-TEN, TRI-TEN or "T-1" brands, that add valuable inches of clearance with less weight and reduced foundation costs.

Steel production facilities increased. The steel industry has greatly expanded its facilities for manufacture of structural shapes and plates. You can confidently design in steel—the material you know best, and the material that offers most—knowing it will be available.

USS, MAN-TEN, TRI-TEN and "T-1" are registered trademarks

USS Steels for Bridge Design

Structural Carbon Steel 33,000 psi minimum yield point	**USS MAN-TEN High Strength Steel** 50,000 psi minimum yield point
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USS

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

The Readers' Guide

Currently, there is no hotter subject than that of the use of consulting engineers on the design of public works. The great, lumbering interstate highway system with its stimulation to the build up of state highway departments is the immediate cause of most of the sound and fury, but for many years, and in many areas, the topic has been a lively one. From time to time, various and assorted engineering organizations have attemped studies of comparative costs of design work. If it has been relatively easy to get cost figures on work by consultants; it has been anything but so to get comparable figures from government agencies that do their own engineering. Therefore, lacking other data, consultants have relied on the pleasant figures published in 1955 by the Task Force on Real Property Management of the second Hoover Commission. This Task Force Report is one of those documents often referred to but seldom read. And even those few who have read it failed to look into its origins and its documentation. Fearing that too many consulting engineers and too many engineering organizations may be resting their case on flimsy evidence, we went to the U. S. Archives and had microfilm copies made of all the original memoranda and correspondence from which the Task Force staff prepared the report. These we studied thoroughly, arriving at the conclusions published in this issue. We now feel that to argue the case of the consulting engineer on the basis of this report is to rest a good case on bad evidence. To request its updating is to plead for a reworking of barren soil.

Last Word on the Hoover Report

(page 100)

The demonstrated ability to run a business office is a skill that separates the consulting engineer from the rest of the engineering profession. If he fails here (and this is a most vulnerable area for most consultants), he must move out of private practice and back into the ranks of employee engineers. The business decisions, large and small, permit no reliance on either handbook formula or original technical concepts. They are problems of people rather than of things. Answers can seldom be proved except pragmatically. This type of decision is better made on the basis of what has worked for others than on that of theoretical rights and wrongs. Therefore, consulting engineers should be most interested in comparing their office policies and practices with those of many of their colleagues. We publish in this issue the results of a survey conducted for Consulting Engineers Council by Ben Persons, a vice president of Dames & Moore.

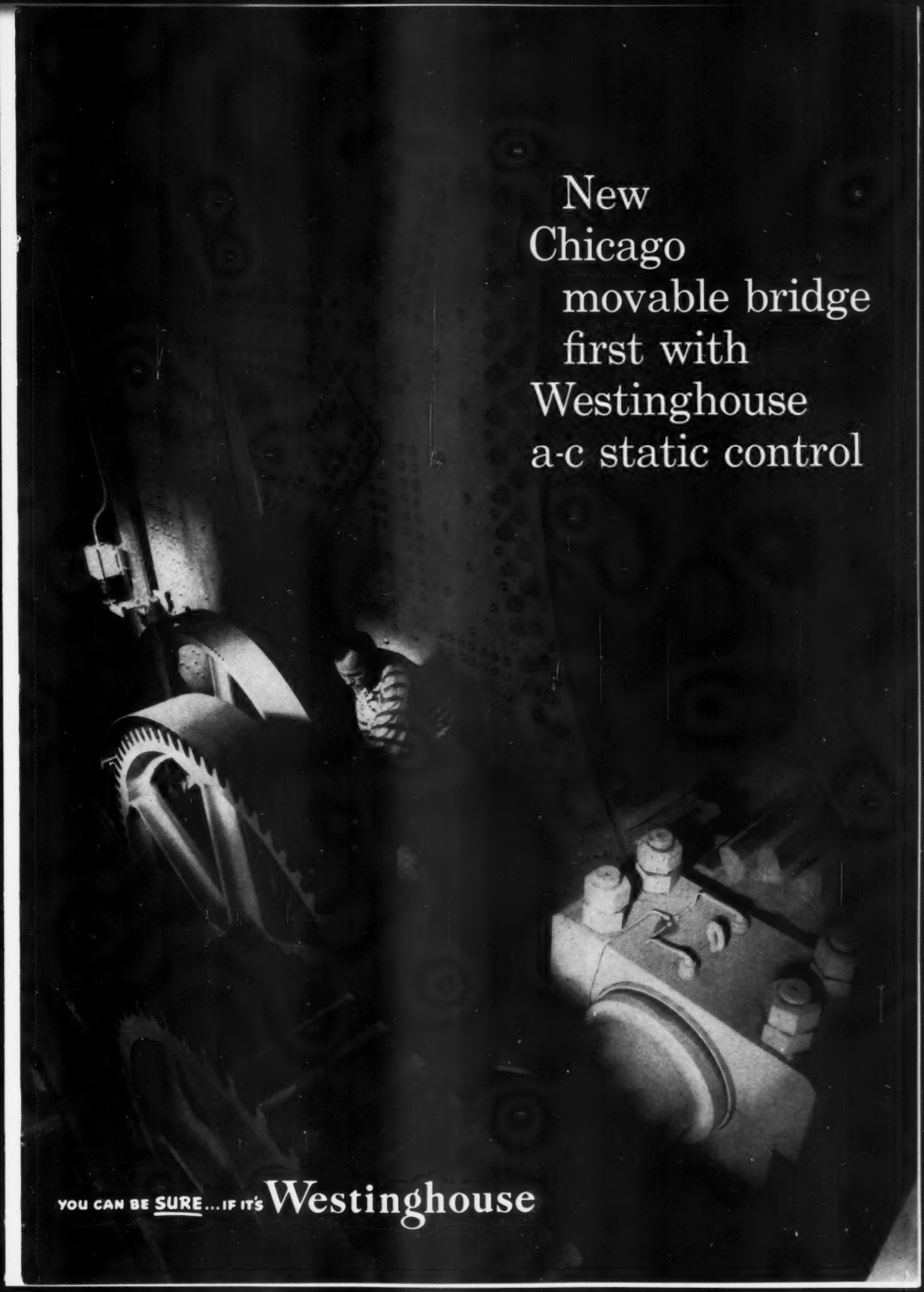
The Consultant as an Employer

(page 122)

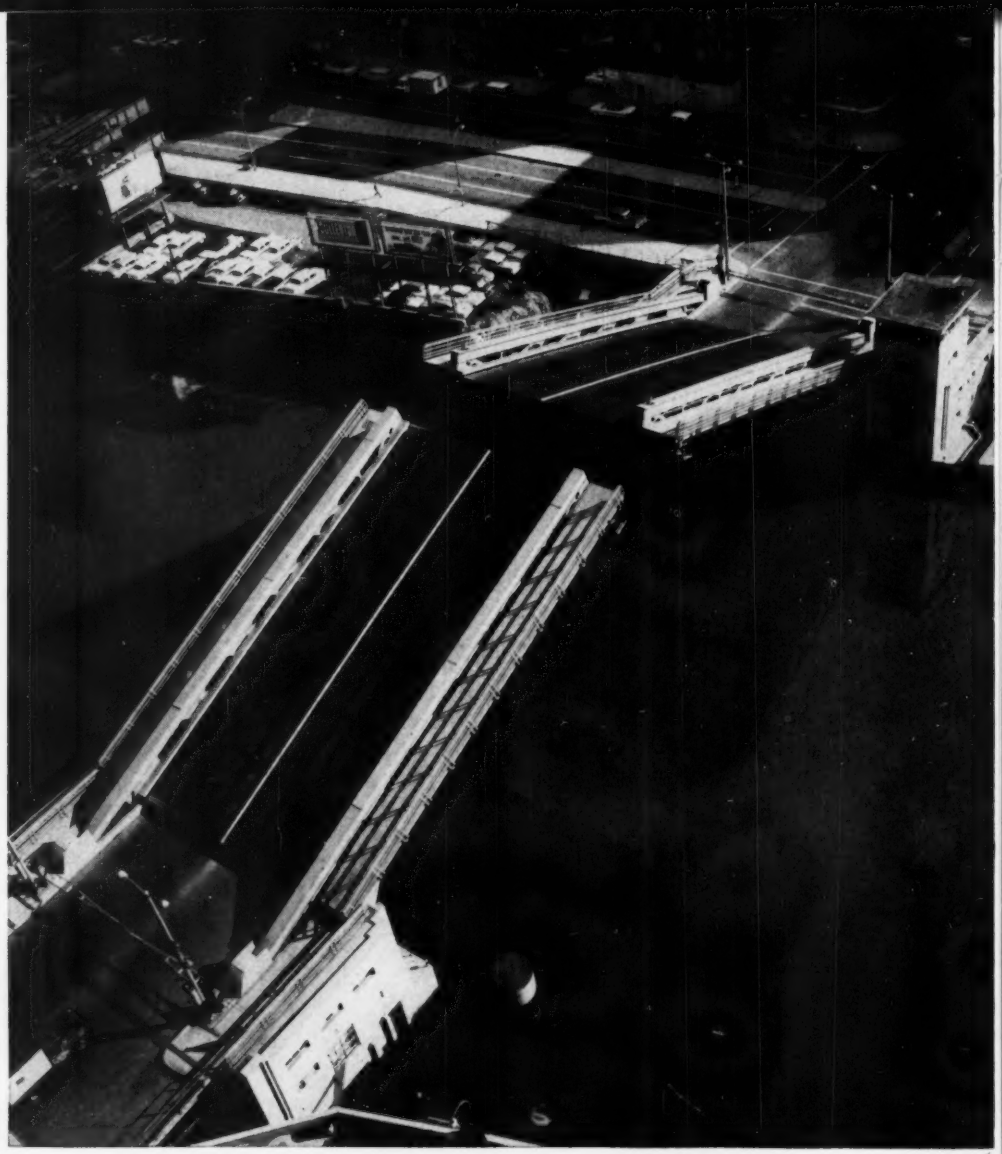
No one has ever denied that the consulting engineer who prepares the specification is an important purchasing influence, but there are all degrees of influence. The performance specification is appropriate in its proper place, but on most projects consulting engineers prefer product specifications, and the tighter the better. Obviously, the more firmly the engineer can specify, the less likely the substitution and the change order. This is carried to its excellent ultimate when the consulting engineer not only specifies but actually acts as the purchasing agent for his client, handling the purchase order and contracting in the name of the client for the specific products to be purchased. This in no way eliminates product competition for the manufacturers compete in their efforts to sell their products to the engineer. It does eliminate competition on a purely price basis of the type in which contractors must indulge in order to survive. The client gains and no one loses. In fact the good contractor is most happy to be able to bid on a job that pays him for his building skill rather than for his sharpness in dickering over cuts or kickbacks. J. E. Sirrine is one of the South's most distinguished firms of engineers, and George Morgan is one of its outstanding principals. He explains in this issue how Sirrine benefits its clients by acting as a purchasing agent.

The Consultant as a Purchasing Agent

(page 94)


New
Chicago
movable bridge
first with
Westinghouse
a-c static control
YOU CAN BE SURE... IF IT'S Westinghouse

COVER PHOTO: View at West Van Buren Street Bridge, Chicago, showing leaf rack, pinion and main drive gearing operated by Westinghouse Bridg-O-Matic control to raise and lower east leaf of bridge.

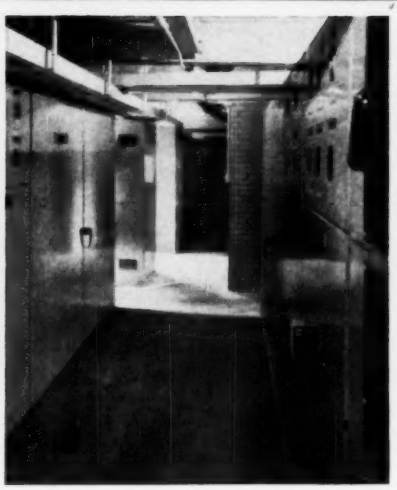


Double leaf, trunnion bascule bridge opening for Chicago River traffic. One man in operator's room, East Pier, upper right, controls the bridge by means of an all a-c system employing Westinghouse saturable reactor-type controller.

J-94132-2

W. C. Carl, Construction Engineer, Westinghouse (standing), discusses Bridg-O-Matic drive with Stephen J. Michuda, Chief Bridge Engineer, City of Chicago, at right, and his staff (left to right): S. Frayer, Structural Engineer; M. D. Krausman, Assistant Chief Bridge Engineer; and R. H. Keil, Electrical Engineer, Bridge Division.

Stephen J. Michuda; M. B. Trimble, Construction Sales Engineer, Westinghouse; and William G. Divane, President, Divane Brothers Electric Company, Electrical Contractors, discuss main control desk which centralizes operation of leaf and auxiliary drives and selection of east and west incoming service feeders. Instruments on sloped panel indicate leaf position and electrical circuit conditions.



View of switchboard room showing incoming line switching equipment, magnetic control for auxiliary drives, Bridg-O-Matic wound rotor motor control panels and saturable reactor cubicles. Robert E. O'Brien, Chief Electrician, examines panel containing emergency control switching equipment at far end of room.

Westinghouse Bridg-O-Matic Control specified to operate Chicago's West Van Buren Street Bridge

An important factor in the design of the West Van Buren Street movable bridge in Chicago was the selection of the most efficient drive and control system available. Westinghouse Bridg-O-Matic* control was specified after a study of its advantages over other types of control.

The West Van Buren Street Bridge is a double leaf, trunnion bascule bridge across the south branch of the Chicago River and is designed to carry vehicular and pedestrian loads. Each bridge leaf is normally operated by two 100-hp a-c wound rotor induction motors. For emergency operation, a single motor per leaf may be used. During normal operation, the time required to open or close the bridge is approximately 55 seconds. Four electrically operated thrustor brakes are provided for holding each leaf in the desired position. Minimum brake shoe lining wear is encountered since the leaves are normally retarded by the motors through the action of the static reactor/Magamp controller to a low speed before the brakes are caused to set.

The normal control of the two operating motors for each leaf, connected for parallel operation, is by means of the Bridg-O-Matic control (a-c reactor control system). The speed torque performance of this system provides precision operation under all conditions of leaf load from normal to a 10-lb wind, without the use of any "mechanical" braking, for positive slowdown and reduced speed operation.

Electric power, supplied by two independent networks, is three phase, four wire, 60 cycle at 208/120 volts, stepped up at the bridge through transformers to 480 volts.

An alternate control system may be selected by moving the control selector switch from "Reactor" to "Off." This provides the conventional reversing wound rotor controller with six power points and a drift point. Either motor may be used. (*contd.*)

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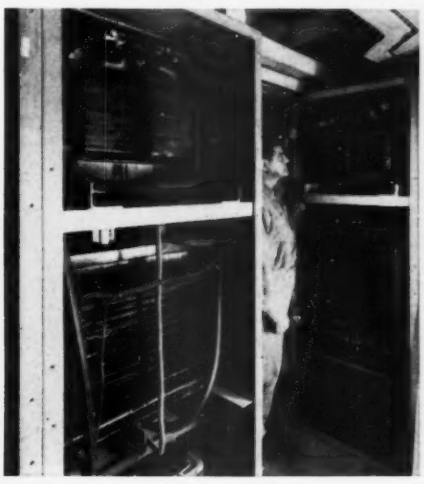
*Trade-Mark

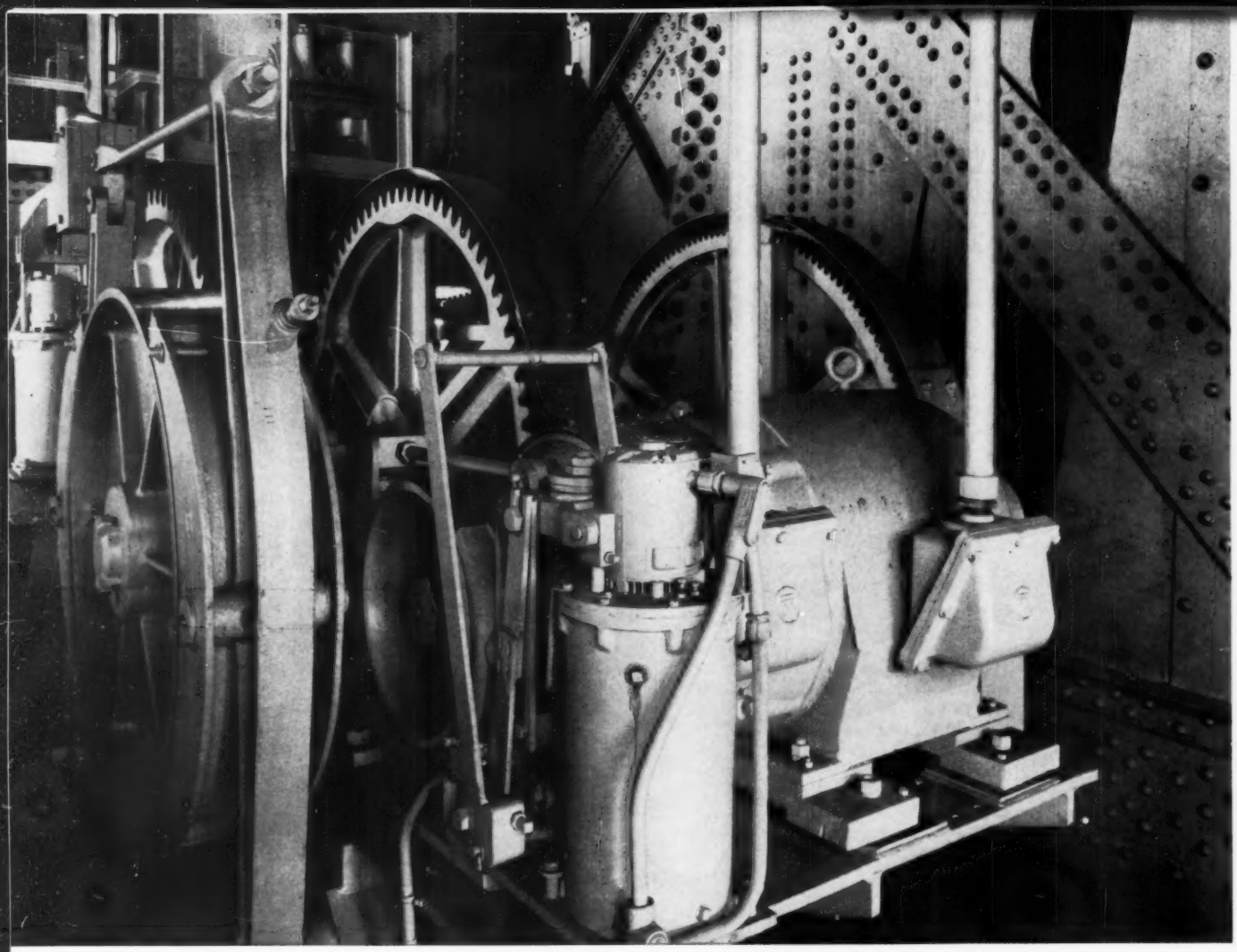
J-94132-3

L. A. Johnson, Westinghouse Sales Engineer; E. A. Leske, Electrical Engineer, Divane Brothers Electric Company; and R. H. Keil inspect Westinghouse Magamp control section of bridge switchboard.



Chief Electrician, Robert E. O'Brien, checks cubicles which house Westinghouse primary saturable reactors.

Incoming line cubicle of bridge control (switchboard room, East Pier) is inspected by W. C. Carl; Edward Klausner, Engineer in Charge of Bridge Construction; and R. H. Keil.



View showing one of leaf drives (there are two per leaf), each with Westinghouse 100-hp a-c wound rotor motor and a-c thrustor-operated motor and machinery brakes.

Westinghouse Bridg-O-Matic operates Van Buren Street Bridge (contd.)

Interlocks are provided in the control system to prevent operation of leaves until all flashers, traffic lights, gongs and warning horns are operating, traffic gates are down, and bridge centerlocks are withdrawn.

Westinghouse saturable reactor a-c systems offer many possibilities for vertical lift, bascule or swing bridge designs, and other applications such as dam and lock gates, cranes, hoists, etc. For more information call your Westinghouse electrical construction engineer, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. J-94132-4

OWNER & DESIGNER: City of Chicago, Ill.
Department of Public Works, Bureau of Engineering
Division of Bridges and Viaducts

CONSULTING ENGINEER: Hazelet & Erdal, Louisville, Ky., and Chicago, Ill.

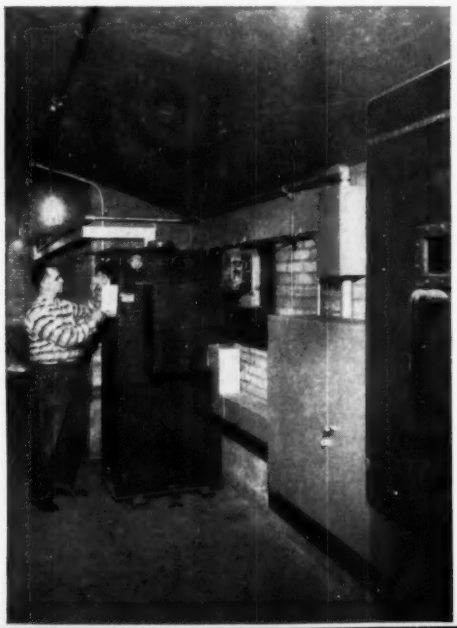
ELECTRICAL CONTRACTOR: Divane Brothers Electric Company, Chicago, Ill.

SUPERSTRUCTURE-MACHINERY CONTRACTOR:
Overland Construction Company, Chicago, Ill.

STEEL FABRICATOR: American Bridge Division, United States Steel Corporation, Pittsburgh, Pa.

YOU CAN BE SURE...IF IT'S Westinghouse

John A. Machiels, Bridge Maintenance Machinist, looks at the 225-kva Westinghouse Inerteen®-filled step-up transformer which provides 480-volt supply for bridge drive motors and auxiliaries. Type DB-50 wall-mounted circuit breaker provides main feeder protection.



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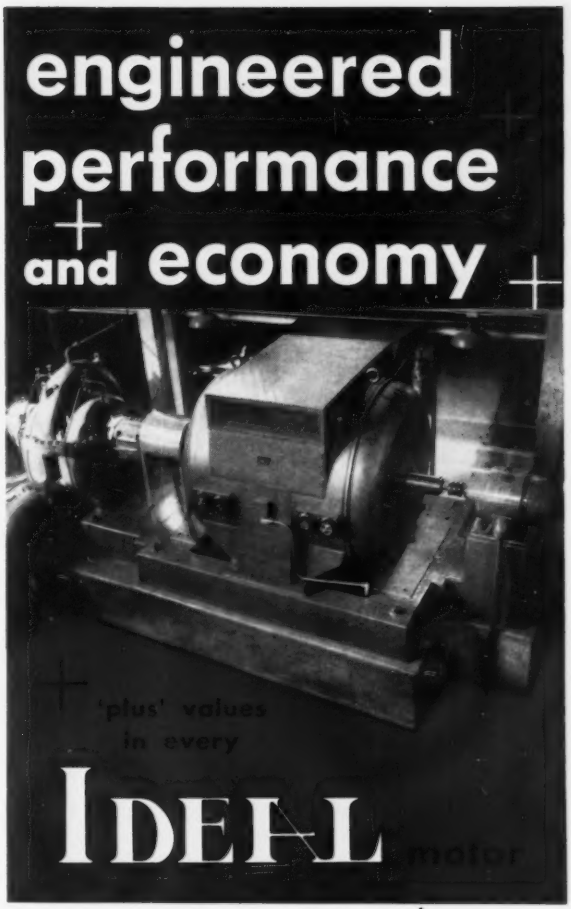

Originally purchased for use as a spare in the City of Cleveland's Fairmont and Division Street Pumping Station, this IDEAL 1750 HP synchronous motor remained in operation as an integral part of the city's water supply system after final acceptance tests were completed.

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From the Editor's

Tranquil Tower

Restrictive Registration Is Wrong

A FIRM of consulting engineers that had always been thought of as large enough and experienced enough to handle just about any type of engineering project recently secured a design contract in the District of Columbia. Looking into the matter of registration in the District, it was found that the roster of registered engineers shows, beneath the name of each, the particular field in which he is qualified to practice. This is not a unique practice (McCawley's compilation of *Professional Engineering Registration Laws* shows that this is authorized in 11 registration laws), but the District of Columbia would appear to have carried it to a ridiculous ultimate by listing 134 separate fields in which an engineer may be licensed to practice.

Since it appears that each registrant is limited to one field of engineering, it is fortunate that the fields are in many instances, multiple. Still, the list is so complex and so dependent upon further definition that it must be difficult for a consulting engineer, particularly a partner or principal in a firm doing a variety of projects, to decide just how much he limits his practice by selecting a particular field of registration.

What registrations would be required to design a small processing plant? Would Structural, Mechanical, and Electrical be enough? Or would a design project of that type require registration in Chemical, Chemical/Industrial, Chemical/Safety, Civil, Civil/Architectural, Civil/Construction, Civil/Industrial, Civil/Plumbing, and so on and on down to a particularly confusing category labeled simply "Technical?" (What on earth is a "Technical Engineer," and in what manner does his training and experience differ from a "General Engineering Engineer?"

The registration board of our Nations Capital has waded deeper into the morass than most, but its error, so clearly displayed here, is merely an exaggeration of an all too common mistake of engineers everywhere. It has been a fault of the engineer to treat some small technical area in which he is particularly adept as though it were a great branch of engineering, then proudly apply some restrictive adject to his title. This may make sense for engineers in industry or research who specialize in narrow technical fields like dielectric breakdown or high temperature creep, but it is seldom logical for a consulting engineer who engages in design and supervision of construction. Rarely does one find a project that is, in its entirety, mechanical, electrical, or structural. So simple a mechanical device as a pump is usually electrically driven and controlled, and it must be mounted on a structure. If the District Registration Board were to be rigorous in its interpretation, the seals of 10 or 15 different engineers could be required on the drawings of a simple pumping system.

Technical segregation is to be discouraged. Consulting engineers should be free, as are doctors, lawyers, and architects, to use their own judgment as to their qualifications. The medical profession has its specialists, but the fields of specialization are additive rather than restrictive. The brain surgeon is a specialist in a delicate operative technique, but this is in addition to his being qualified to set a broken leg. His special skill does not prohibit his writing a prescription for sleeping pills for a patient with insomnia.

There are some architects who concentrate their talents on the design of churches, but no law states that the architect who has demonstrated his ability to design a church is thereby forbidden to design a school or a residence. So should it be in engineering. There is considerable demand for the services of the specialist, and the more complex the design, the more specialists are needed, but the fact that some engineer has distinguished himself

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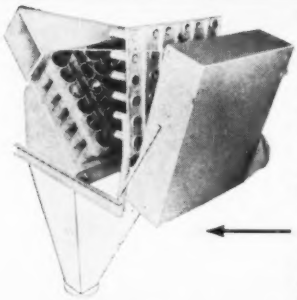

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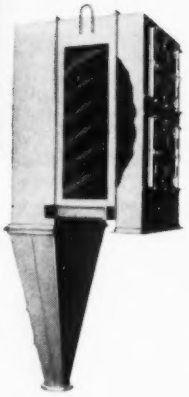

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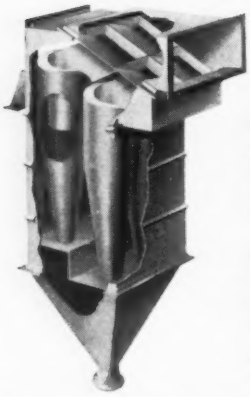

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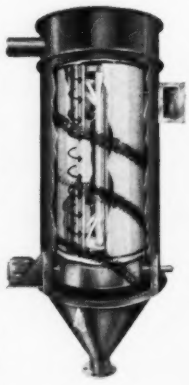

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in some narrow field should not disqualify him from participation in the general practice of engineering. The consulting engineer, like the doctor and the lawyer, should be a general practitioner first and a specialist second.

Some engineers – some consulting engineers – argue that there is good reason for registration by fields of practice. They insist that there are some engineers who do not acknowledge their own limitations and must legally be prevented from undertaking projects beyond their ability. No doubt there are such men, and it is likely we could find them also in medicine, law, and architecture as in engineering. But laws specific enough to prevent a man from practicing outside his specialty would protect the client less than they would hamper the profession. Even without restrictive registration, it is difficult enough for a consultant to expand his operations. Most clients, understandably, are willing to deal only with an engineer with an experience record. Registration by field simply makes impossible the already difficult task of diversification. One must have experience before one can register, and one must register before one can gain experience. Rather than restrictions, most engineers need encouragement to go into diverse and challenging areas.

Fortunately, neither the American Institute of Consulting Engineers nor Consulting Engineers Council have ever laid any emphasis on their members' fields of technical specialization. In both organizations the members are simply "consulting engineers" – not mechanical, electrical, civil, structural, or chemical engineers. This is as it should be, and these bodies should make every effort to expand the concept of the consulting engineer as one whose field of technical specialization, if any, is in addition to, certainly not to the exclusion of, his basic technical competence. ▲▲

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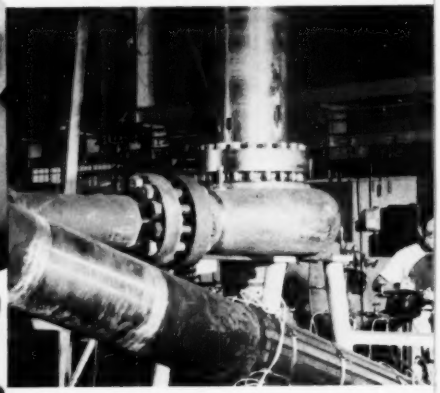

PRECISE ALIGNMENT, here being performed on a special granite slab, is typical of both the special facilities available, and the care and skill of workmanship built into each BJ Pump.

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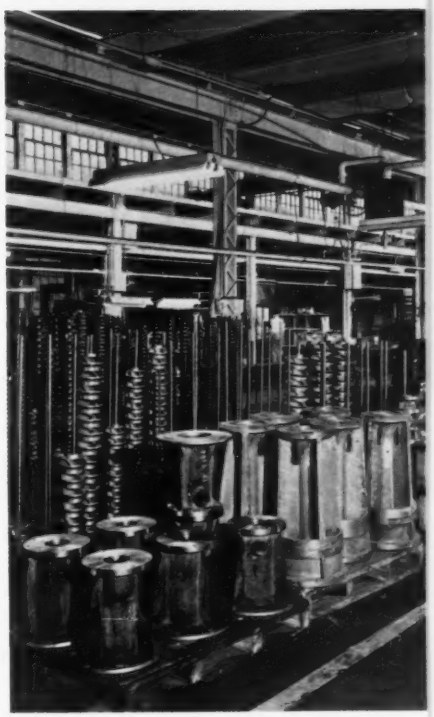

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First, on standard type BJ Pumps, adequate inventories of all initial and spare parts are kept at strategic locations throughout the country. Complete pumps or parts can be delivered almost off-the-shelf!

For custom engineered BJ Pumps, an extra large and efficient engineering department is at your command to produce a pump to your specifications —yet with the background of BJ's experience in quality manufacturing since 1872.

After engineering approval, BJ's complete and advanced facilities, some of which are shown here, go to work to build your pump, and to prove its worth through the numerous tests.

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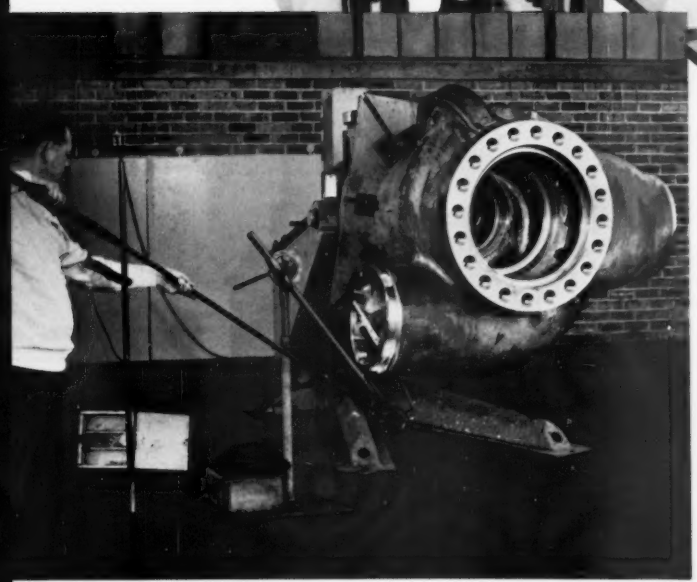

RADIOGRAPHIC INSPECTION of castings, shown here, as well as helium leak testing, dye penetration, ultrasonic and Magnaflux inspections are the type of control procedures used to build the quality in BJ Pumps.

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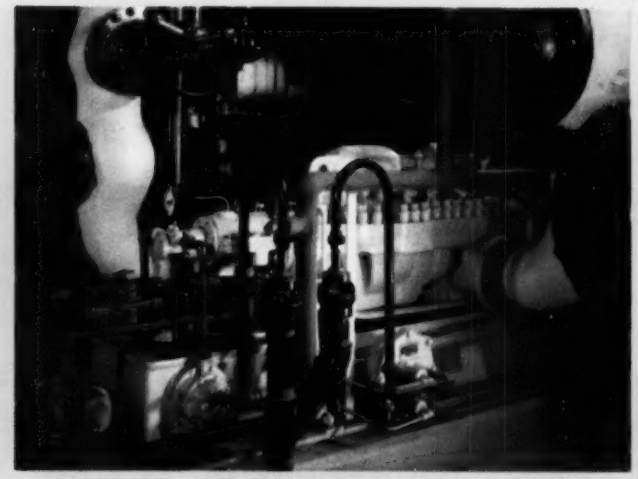

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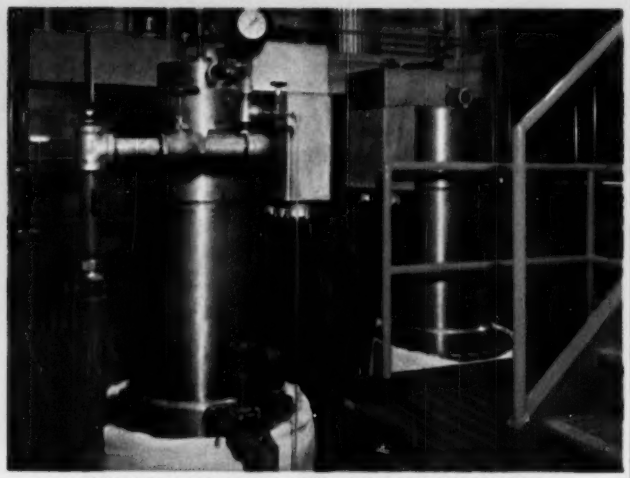

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Readers' Comment

AIChE Dates Its Code

The question of ethics and the adoption of the Code by AIChE is surrounded with a little bit of mystery.

As you know, there is a Code printed in our 1912 Transactions. This, apparently, was voted at the Washington meeting of AICE which was held in 1911. In the 25th History of the AIChE, G. W. Thompson, who was on the Ethics Committee, said in a publication dated December, 1932: "It is now about 20 years since the 'Code of Ethics' (Article V of the Constitution) of the AIChE was adopted. The incorporation of this Code into the Constitution was made in 1928."

So we see that the Institute adopted a Code in 1912, which was proposed at least as early as 1911, and the incorporation of it into the Constitution waited until 1928.

I think the facts stand by themselves, namely, that AIChE had a Code of Ethics in 1912 which was made a part of the Constitution in 1928.

F. J. Van Antwerpen
Secretary, AIChE
New York, New York

Competence vs. Professionalism

Your article ["Engineering Ethics . . . The Search For A Single Code," July 1960, page 112] is comprehensive and I believe will do a great deal of good if the right people would read it. It is long past time that the engineering profession actually became professional. I am of the general opinion that more ground work could be laid in universities in the future where the average professor is emphasizing . . . competence with little thought of professionalism.

R. C. Ernst, Dean
University of Louisville
Louisville, Kentucky

Engineers and Ethics

I have found your article on engineering ethics most interesting and highly informative. This is a subject which needs continuing attention from all members of the profession, and I feel that even the employee engineer needs to be indoctrinated because this broad field of professional ethics encompasses not only our relations with the public but it includes necessary rules governing the relations between practicing engineers and employer-employee groups. I am convinced that we all have a joint interest in the end result from operating under ethical standards.

My attention has just recently been invited to the annual address of the president of the American Society of Civil Engineers where he seems to point with pride to the fact that "instances of punitive ac-

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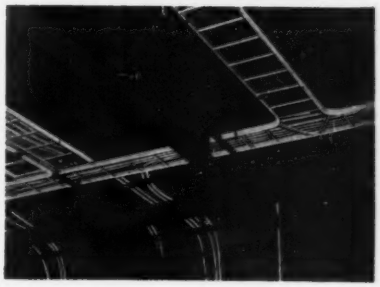

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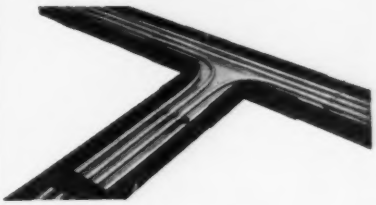

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tions for violations of our Code of Ethics are relatively few." I have the feeling that the engineering profession has not quite reached the stage where we should brag about the scarcity of action taken against violators of the Code of Ethics. In my 40 years of practice, I have had occasion to observe many instances where the main objective of engineering societies was to cover up rather than to correct the end results of malpractice.

We have generally failed to teach our student engineers any of the basic elements of professionalism or ethical standards with the result that they go forth into the world entirely unacquainted with these two basic elements of a profession. We could well take a leaf from the established courses in our medical schools and colleges of law in this direction.

J. B. Dannenbaum, P.E.
Houston, Texas

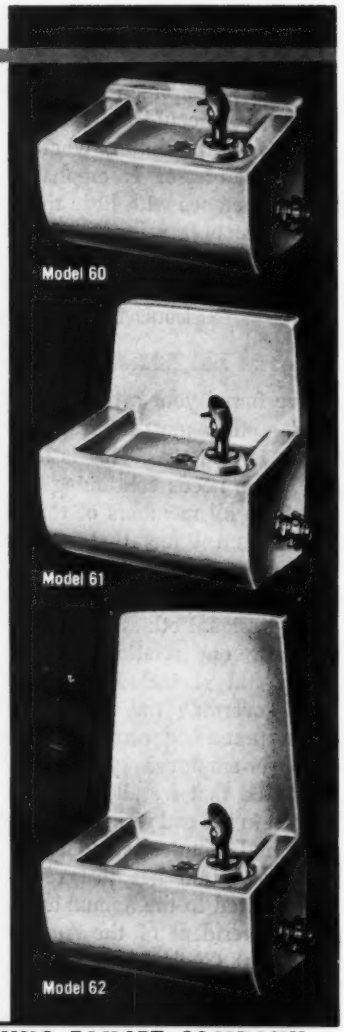
FOUR DISTINCTIVE HAWS FOUNTAINS SMARTLY STYLED IN VITREOUS CHINA

HAWS

"The Series 60"...refreshing new styling with the durable beauty of gleaming vitreous china, permanently in good taste. All are wall-hung models, based on the same appealing design. Choose the model that best fits your plans...or choose several to complement each other in varied locations. Sanitation? Only HAWS has the exclusive M fountain head...raised, shielded, anti-squirt angle stream. Automatic flow control, too. Get detailed specs from HAWS. Write today.

Model 62-GF: HAWS glass filler faucet installed on back of Model 62, for double-duty convenience.

Ask for your free copy of the new HAWS Catalog.



HAWS DRINKING FAUCET COMPANY
1441 FOURTH STREET (Since 1909) BERKELEY 10, CALIFORNIA

Semantics — Not Ethics

We have noticed in the June issue of CONSULTING ENGINEER, under "Scraps & Shavings," on page 196, there is an article concerning the New Jersey State Highway Department that is captioned "Bidding by Consultants?"

This letter is being written to eliminate any misinterpretation caused by a poor choice of wording on someone's part, and to explain the policy under which we operate.

When a project is contemplated it is reviewed by our engineers as to the work involved, its type, and extent. We then review our list of consultants as to their capacity to properly accomplish the objectives of the project.

The firm which our engineers recommend is called in, the work described, and a date set for the consultant to be accompanied by one of our District Engineers to go over the area involved in the field. This firm is offered the opportunity of submitting a *proposal*.

The only extent to which fees are mentioned is with respect to whether we prefer lump sum, cost-plus, or percentage for the particular work to be performed. We have had some $12 million of consulting contracts for location studies and design projects. All of these contracts have been made on the above basis.

We have prided ourselves on the high type of consultants with whom we are willing to do business and doubt that they would lend themselves to anything that may be considered unethical in any form.

Dwight R. G. Palmer
Commissioner
State of New Jersey
State Highway Department
Trenton, New Jersey

Certification — Approbation

Your article ["Your National Certificate – What's It Worth," page 173] in the June 1960 edition of CONSULTING ENGINEER has aroused

New Airfoil Bladed Fans Whisper

Here's a completely new line of Airfoil Bladed Fans from American-Standard Industrial Division with an exclusive radial rim wheel design that substantially lowers air velocity through the blast area of the wheel. This new design, plus airfoil blading, reduces turbulence and results in unusually quiet fan operation. Exceeding 90% in mechanical efficiency, American-Standard* Airfoil Fans are ideal for both general ventilation and industrial process applications. And every one carries the AMCA certified rating seal. Get all the facts. Send for Bulletin A-1103 today. American-Standard Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Limited, Toronto, Ontario. *AMCA Certified Ratings*

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AMERICAN-Standard
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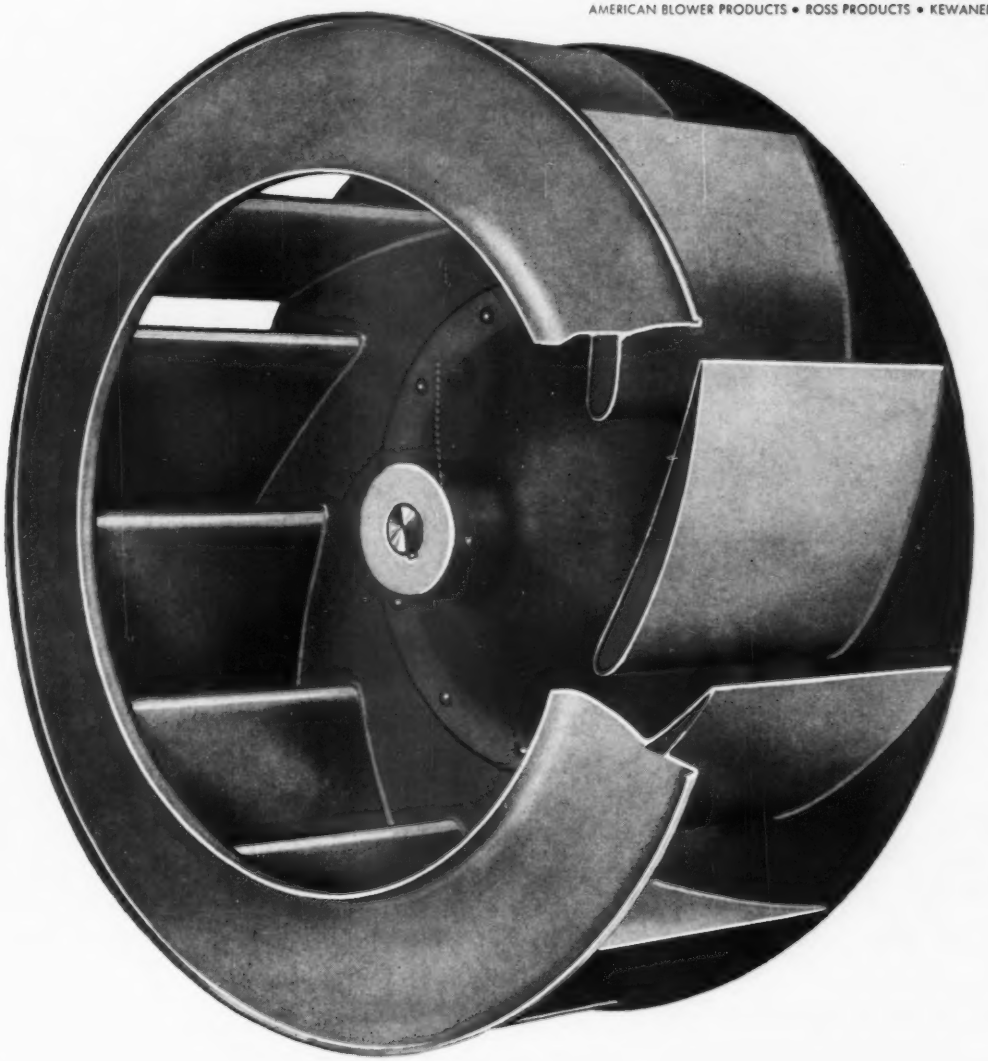
AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS



the interest of the principals and associates alike in our organization with respect to certification by NCSBEE.

Accordingly, we would be most appreciative of any information that you may be able to provide regarding the procurement of such certification.

You may rest assured that we eagerly look forward to receipt of each edition. In our opinion, this publication is one that serves to provide practicing consulting engineers with a long needed aid in fulfillment of a solution to our common problems.

Reed M. Wright
Adams, Morgan, Latham, Kripp & Wright
Long Beach, California

Vacillation on Socialism?

I would be sorely amiss if I did not write to compliment you most highly on your excellent editorial in the June issue, page 22, a most appropriate and vigorous, but not very Tranquil Tower. You have done the American Society of Civil Engineers a great service by pointing your finger at its vacillating stand on government practice of engineering. You have given us all a well deserved shaking up.

Are extra copies of your editorial available? I should like to purchase three dozen of them to make sure that they reach the ASCE Board of Direction and appropriate officers. I hope others may see that it gets proper attention elsewhere, and I hope that it can get proper attention from all our engineering societies, because it would help a lot to set our thinking straight on all manner of creeping socialism, both in and out of Washington.

Bengt F. Friberg
Consulting Engineer
St. Louis, Missouri

FIDIC and the Word Bank

I just returned from a trip to Europe which included attendance at the General Assembly Meeting of FIDIC in Stockholm. Of particular interest to me was the fact that the officers of FIDIC, upon recommendation of the British Association of Consulting Engineers, took steps to delete the limitation of 10 percent on Sureties as set forth in Section 10 of FIDIC's International Conditions of Contract. President Tritton spoke quite favorably before the General Assembly concerning the results of his investigation of the Performance Bonds.

In reading the June 1960 issue of CONSULTING ENGINEER, I was impressed by the information contained in the article "Getting Together Means Business," prepared by The Economist Intelligence Unit Ltd., pp. 136-140 inclusive. Would it be possible to obtain say 10 or 12 reprints of this article for distribution within the Bank.

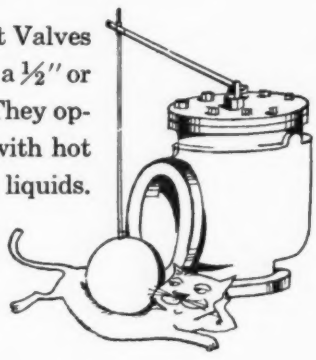
Gail A. Hathaway
Engineering Consultant
Int. Bank for Reconst. and Dev.
Washington, D. C.

LIQUID LEVEL CONTROL

G-A *Cushioned* Float Valve

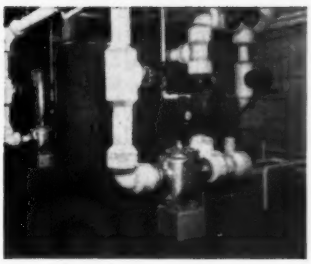
Sensitive Golden-Anderson Float Valves automatically hold water level to a ½" or 1" variation in tanks, bins, etc. They operate at high or low pressure—with hot or cold water—and most other liquids.

Bulletin W-5A has all the facts.



GOLDEN ANDERSON Valve Specialty Company
1280 RIDGE AVENUE, PITTSBURGH 33, PA.
Designers and Manufacturers of VALVES FOR AUTOMATION

Consulting Engineers for Baylor University Medical Center: Zumwalt & Vinther, Dallas. Architects: Thomas, Jameson & Merrill, Dallas. Plumbing Contractors: Brown & Olds Plumbing & Heating, Dallas.

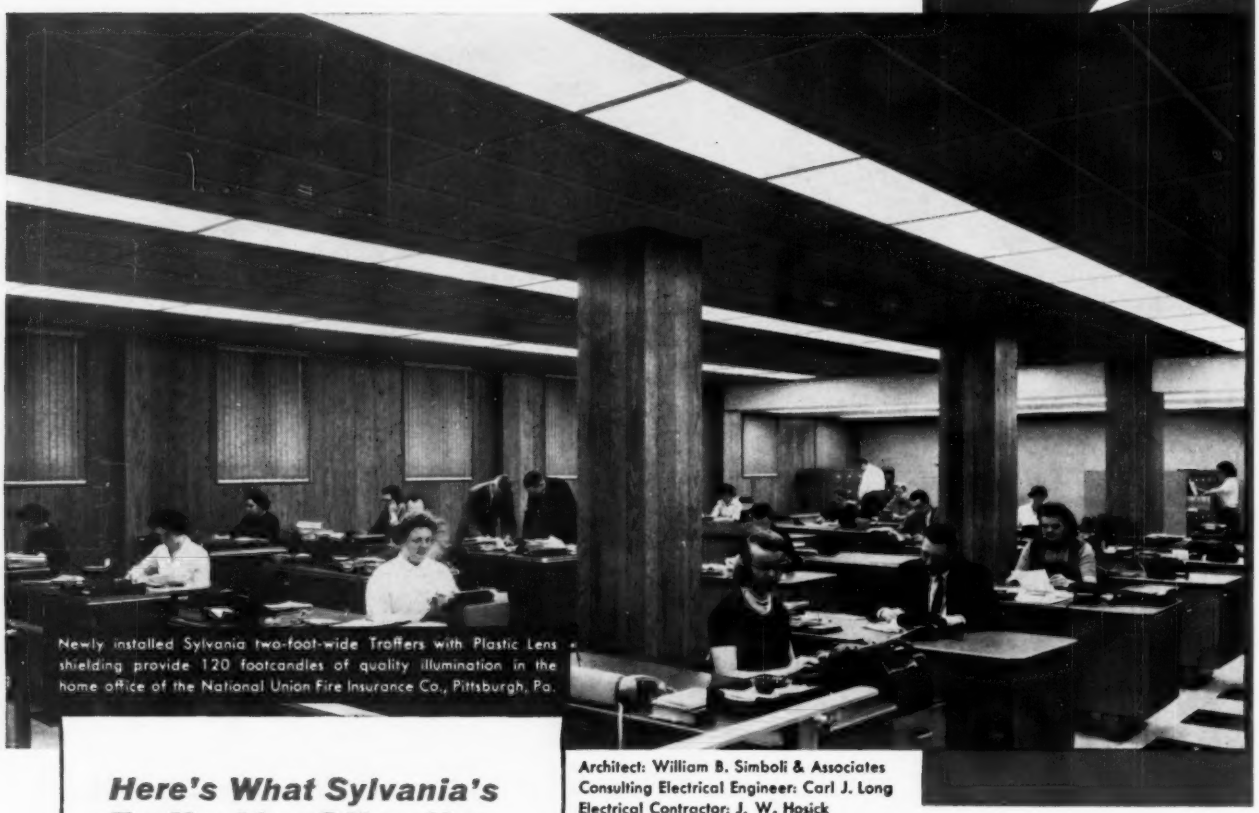


High Capacity **BRUNER** Equipment Supplies Soft Water for Baylor University Medical Center, Dallas, Texas

Soft water used in laundry and dietary facilities for Baylor Medical Center's three hospitals improves the appearance of uniforms and linen, makes dishes shine, cuts soap consumption by approximately 50%. Here, and across the U. S. leading engineers specify Bruner water softeners, America's most complete line. Full information is available from Bruner Sales Offices in all major cities.

BRUNER Corporation
4767 North 32nd Street, Milwaukee 9, Wisconsin
DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.

Here's a Sparkling Addition to Sylvania's Popular Troffer Series . . . . . .



Newly installed Sylvania two-foot-wide Troffers with Plastic Lens shielding provide 120 footcandles of quality illumination in the home office of the National Union Fire Insurance Co., Pittsburgh, Pa.

Architect: William B. Simboli & Associates
Consulting Electrical Engineer: Carl J. Long
Electrical Contractor: J. W. Hosick

Here's What Sylvania's Troffer Line Offers You

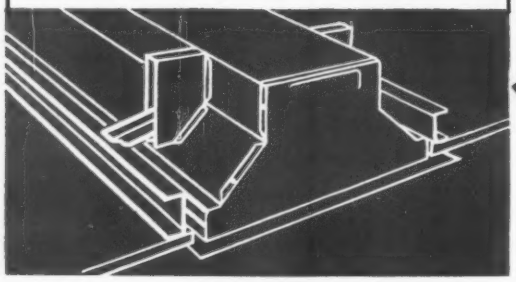
- Only 5½" deep for ideal ballast operation and convenient relamping.
- Broad choice of widths and lengths.
- 2, 3, 4 and 6 lamp units to meet any lighting requirement.
- Concealed hinges and latches.
- Wide selection of shielding media.
- 3 housing types to fit ALL modern ceilings.
- Simple installation in any ceiling.
- Easy access for maintenance.
- 5 types of Accent Units for pattern lighting.

Sylvania's Troffer Series enjoys tremendous popularity for two basic reasons: (1) outstanding product design together with practical, time-saving features; and (2) an extremely wide range of models to fit all modern ceilings and to suit every individual taste.

Now . . . a NEW addition to the famous Sylvania Troffer family . . . the *Air-Handling Troffer* combining the functions of lighting, heating and cooling into one compact system.

Here is a unit that blends the lighting features and advantages of Sylvania Troffers with the air handling experience of The Pyle-National Company.

With Sylvania's Air-Handling Troffer you obtain the correct, controlled atmosphere so essential for top effi-



Unique Snap-Up Hanger

The simplest, most effective method of installing troffers in acoustical ceilings and in plaster ceilings with metal framing.

Fixture snaps into place and is supported by toggle arms of Snap-Up Hanger. Positioning and leveling of troffer takes only a few minutes.

The All-New AIR-HANDLING TROFFER

by SYLVANIA

ciency working performance. The coordination of mechanical facilities results in excellent overall economy. And uncluttered ceilings, free of separate diffusers, meet the goal of alert designers today.

All of the key features of Sylvania's Troffer Series are incorporated in this new fixture. The air-mixing chamber plus the valve and other air handling accessories combine for a minimum plenum chamber depth for most effective space utilization. The wide selection of fixture sizes, shieldings and number of lamps permits any lighting requirement to be met efficiently and economically.

The low-velocity air-diffusion system provides efficient, uniform air distribution for year-round comfort. Noises, drafts and soiled ceiling areas are minimized. Because the low-velocity system does not depend on walls or partition locations, room space assignments can normally be changed without affecting the efficiency or operation of the air flow.

This combination of quality lighting and efficient air-handling fits well with many building or remodeling plans. Perhaps you can use these convenient, money-saving advantages on your next project. Write today for complete information.

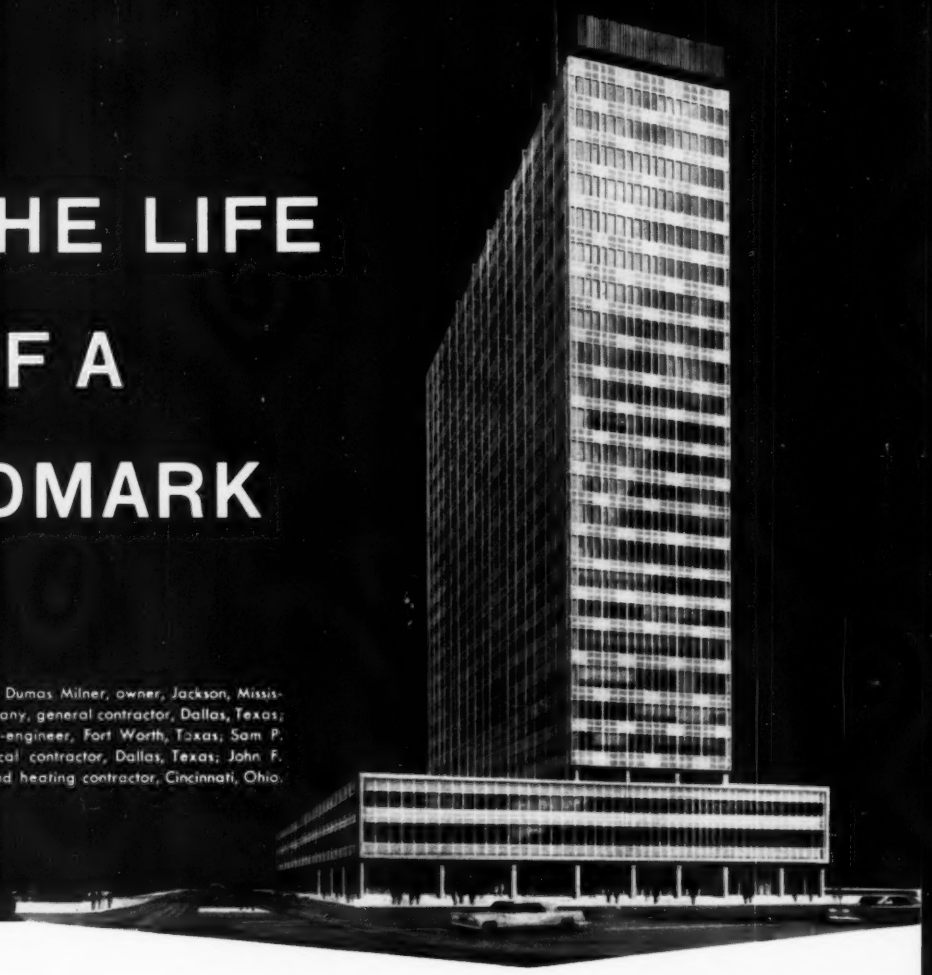
SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
One 48th Street, Wheeling, West Virginia

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

GENERAL SYSTEM

FOR THE LIFE OF A LANDMARK



NEW KROGER BUILDING: R. E. Dumas Milner, owner, Jackson, Mississippi; George A. Fuller Company, general contractor, Dallas, Texas; Hedrick & Stanley, architect-engineer, Fort Worth, Texas; Sam P. Wallace Company, mechanical contractor, Dallas, Texas; John F. Deye Company, plumbing and heating contractor, Cincinnati, Ohio.

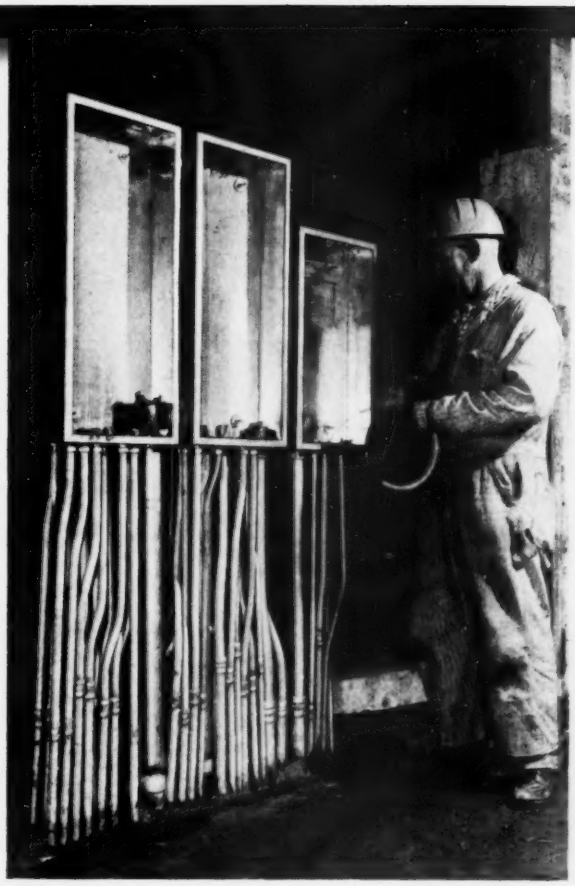
Sheer Stamina... thousands of feet of Republic Steel Pipe installed in Cincinnati's new Kroger Building

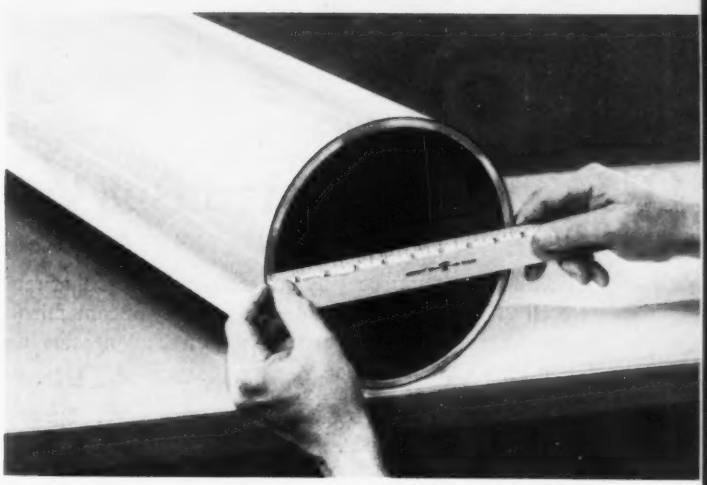
LOCAL REPUBLIC DISTRIBUTORS deliver steel pipe as it is needed on the job . . . clean, rust-free pipe that has been stored under roof. In addition to complete steel pipe inventories, these men offer outstanding lines of fittings, fixtures, and controls.

It was steel pipe for waste lines, vents, and heating lines in this Ohio landmark. Engineers and contractors selected 1″ through 4½″ O.D. Republic Continuous Butt Weld . . . and 5⅝″ O.D. through 12¾″ O.D. Republic Electric Resistance Weld.

Experience shows that you can rely on the strength of steel pipe for long, unsupported runs; on the *economy* of steel pipe for immediate and long range savings; on the resistance of black and galvanized steel pipe to corrosion and fabrication damage; and on the availability of steel pipe for almost immediate delivery.

Your Republic Pipe distributor has complete and helpful data. Call him today or return the coupon at right.





FUTURE ELECTRICAL ADEQUACY: specify Republic ELECTRUNITE® E.M.T. in the next larger size *at no greater cost* than threaded type conduits. ELECTRUNITE provides a pull-in, pull-out grounded wiring system that can be expanded simply by adding or replacing wiring. With Republic E.M.T.—the steel conduit—you don't have to worry about concrete. Installations made more than 25 years ago are still in service today, ready for more years of electrical flexibility.

EXCELLENT CORROSION RESISTANCE: specify Republic Riveted Corrugated Metal Pipe for storm sewers. Made from galvanized Republic Copper Steel Culvert Sheets for long, dependable life. Economy features include: low initial cost, minimum labor and equipment requirements, fast installation, convenient length, 8″ to to 96″ diameters to meet any flow requirement. Send for details on the complete line of Republic Drainage Products.

NEW 6″ AND 8″ X-TRU-COAT LINE PIPE: specify this polyethylene-coated line pipe for proven corrosion resistance. In less than three years, utilities have installed more than 28,000,000 feet of X-TRU-COAT. X-TRU-COAT stops chemical and electrolytic corrosion . . . resists shipping, stringing, and backfilling damage. In addition to the new larger sizes, Republic offers new X-TRU-TAPE Joint Wrap and X-TRU-PRIMER. Return the coupon for data.

REPUBLIC STEEL

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. CI-9906
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

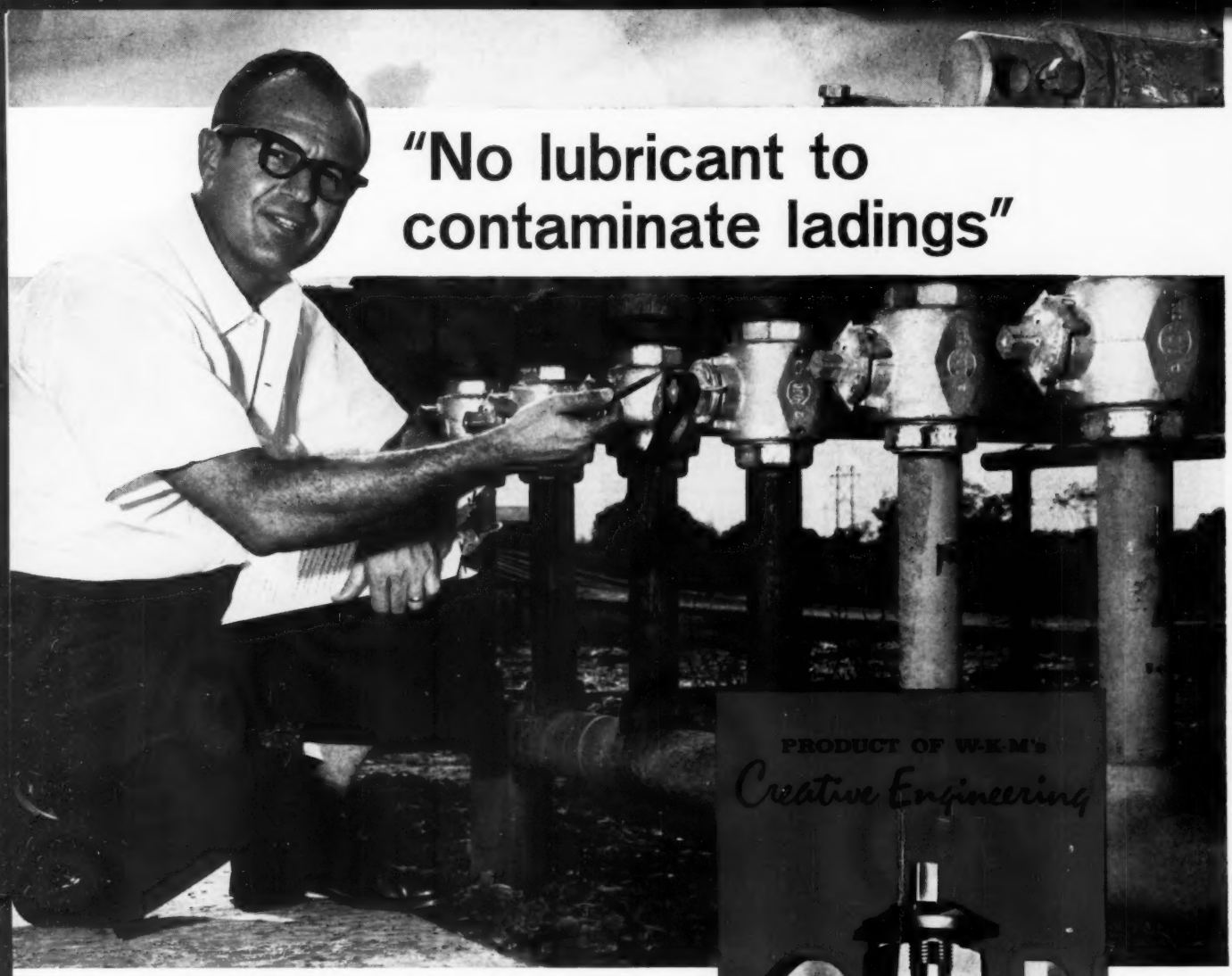
- ☐ Steel Pipe
- ☐ ELECTRUNITE E.M.T.
- ☐ Republic Drainage Products
- ☐ X-TRU-COAT Plastic-Coated Line Pipe

Name_____ Title_____

Company_____

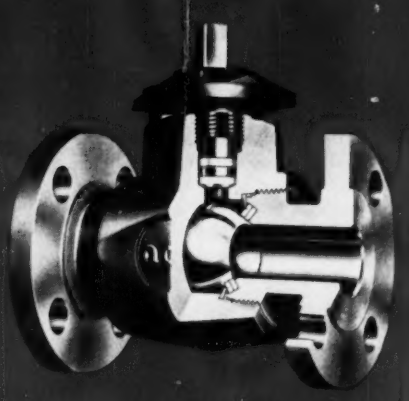
Address_____

City_____ Zone____ State_____



"No lubricant to contaminate ladings"

PRODUCT OF W-K-M's *Creative Engineering*



acf® non-lubricated Ball Valves

ACF Ball Valves are specially designed for ladings that require absolute purity. There is no lubricant, no possibility of contamination. The chrome-plated ball is suspended between Teflon seats under compression for leakproof sealing.

A quick quarter-turn operates this rugged valve. Specify it. You'll get efficient, economical performance. *Available at leading supply stores everywhere.*

Service-proved for 5½ years with such ladings as: gasoline • alkalis • liquefied petroleum gases • acetone • synthetic fuels • paint solvents • toluol • alcohol.

WRITE FOR CATALOG 1000

W-K-M

DIVISION OF acf INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS

ACF non-lubricated Ball Valves feature full bore conduits, Teflon stem gaskets and seats that are sealed from the lading flow.

Working Pressures: In carbon steel with ASA ratings of 150 and 300, and a few sizes in ASA 600; in semi-steel with 200 and 400 pound ratings.

Sizes: ½" through 6".

5911-R2

The Word From Washington

EDGAR A. POE, Consulting Engineer Correspondent

PERHAPS the bitterest Congressional critic of the Mutual Security Program is Representative Otto E. Passman, Chairman of the House Appropriations Subcommittee on Foreign Assistance. By virtue of his position, he has personally been responsible for substantially cutting Mutual Security spending.

Asserting that there are now 43,000 employees and 10,000 trainees in the program scattered among 76 nations, the Louisiana Democrat charges that pressure and propaganda for funds have gotten so great that the Committee and Congress are losing control over spending. Furthermore, he insists that billions in foreign assistance funds are not shown in the Mutual Security Bill.

"Here we are, one country, with a public debt of $290 billion and facing deficits every year," said the Congressman. "Why do we get drawn into a program such as this for 50 percent of the total, when all 14 European countries are putting up the other? Most of these countries, on a per capita basis, have a lower public debt than we do; and they are gaining by leaps and bounds in exports."

DLF Plans

The Development Loan Fund is planning to make at least 140 loans during the 1961 fiscal year. They will go to more than 40 countries and amount to $1.4 billion. Nearly 100 professional and technical people including more than 20 engineers will run the multibillion dollar operation.

Vance Brand, managing director of the Development Loan Fund, said the professional staff will be responsible for processing $1 billion or more in new applications on hand. It also will conduct engineering analyses and negotiations that will result in approving about $700 million in new loans.

"Too often we tend to conclude that once funds are obligated," said Vance, "our purposes are achieved and our work is done, except for billing and collection. Nothing could be farther from the truth. Before disbursement arrangements are approved, the Development Loan Fund must see that conditions specified in the loan agreement are met; that detailed engineering plans, drawings, and specifications are worked out; that contracts are properly awarded; that United States business is adequately informed regarding possible procurement; and that financial and progress reporting is arranged and understood. As of today, these responsibilities cover 118 loans."

These loans, totaling $958 million include:

¶ 36 loans and one guarantee, totaling $220 million for industrial plants and facilities in 22 countries, including. For example, cement plants in five countries, pulp and paper mills in three countries, fertilizer plants in two countries, sugar mills in two countries, plus five loans for irrigation and land reclamation in five countries totaling $52 million.

¶ 12 railway expansion loans in 9 countries, totaling $152 million.

¶ 11 highway loans in 10 countries, $101 million.

¶ 14 port, waterways, airport, and communications development loans in 11 countries, $48 million.

¶ 15 loans in 12 countries, for power generation and transmission and for multipurpose dams, $75 million.

If DLF were to approve no more loans, it still would have responsibilities in 43 countries. However, the agency is going to make more loans this year and next year. In doing so, it will process many more proposals than are ultimately approved.

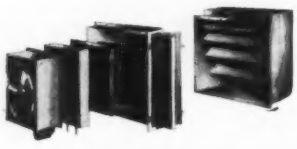
The Inter-American Development Bank is expected to undertake some of the lending in Latin America during the 1961 fiscal year which the DLF would otherwise assume, according to testimony presented to Congress.

Why Not Use Consultants?

Senator Olin D. Johnson maintains that the United States government is losing an alarming number of career engineers, scientists, and professional personnel because the government is not competing with private industry salaries. As a result, many of the highly skilled

Your best investment in modern air-handling equipment! New Aerovent Air Make-Up Units provide clean, fresh air in winter or summer; help maintain uniform temperature levels throughout working areas. Used as filtered-air supply units or air preheaters, these versatile units permit heating and ventilating systems to operate at design efficiency; equalize negative pressures by replacing exhaust air.

Steam, hot water or gas-fired models in sizes 18" to 54" (larger units available on order) for capacities, pressure conditions and BTU ratings to suit your requirements. Compact, packaged design for roof or wall mounting. Other assemblies also supplied for exclusive use in air supply or air heater applications. Why not investigate the many advantages of these high-efficiency units, today?



STEAM OR HOT WATER

Furnished in 7 unit arrangements in sizes 24" to 54". Capacities from 5,000 to 35,000 CFM. Roof or wall types for all requirements.

GAS-FIRED

Supplied in 4 unit arrangements for roof or wall mounting. Sizes 36" to 54" for various capacities, BTU ratings and pressure conditions.

Write for new Bulletin 880

Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance.

CERTIFIED PERFORMANCE

Aerovent FAN COMPANY, INC.

Ash and Bacon Streets — Piqua, Ohio

persons are being replaced in government by those less qualified and below the quality needed to maintain the desired standard of service.

The South Carolinian, Chairman of the Senate Civil Service and Post Office Committee, says that research shows one of every six electronic, mechanical, and aeronautical positions in the government is vacant and similar shortages exist in other critical areas.

There are consulting engineers available, Senator.

Soil Evaluation Device

The Federal Housing Administration has come up with what it calls an engineering short-cut to evaluating potentially dangerous conditions existing in some clay soil residential foundations, utility installations, and driveways. The simple field device is referred to at FHA as the "Black Fox," though it has been formally designated as the FHA Soil PVC Meter 5:6.

PVC (potential volume change) refers to the maximum possible volume change that the soil could undergo when subjected to changing moisture conditions that cause swelling or shrinkage. Some dry soils swell if wetted, while others, originally wet, shrink if dried.

Before the "Black Fox" could be developed, considerable research was necessary to provide satisfactory background laboratory testing data, a summarization of mechanisms causing volume change in soils, and a study of the factors influencing these changes. The device provides two unusually attractive features. PVC tests can be completed in two hours, and even a technician inexperienced in soil engineering and classification can quickly determine the degree of volume change in the soil sample.

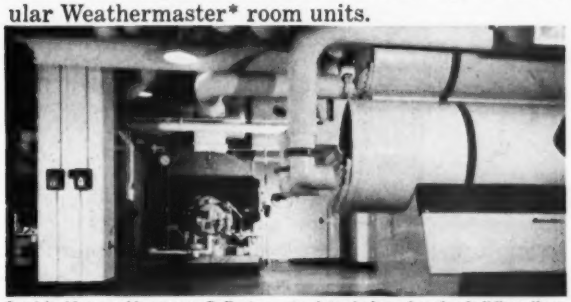
Air Pollution Study

A two-year study of the medical effects of automobile and truck exhaust gases on people is going

New headquarters of Home Security Life Insurance Co., Durham, North Carolina, completely air conditioned with Gas-operated Carrier Absorption Refrigeration. Associated architects: Small & Beaz; Antonin Raymond & L. L. Rado. Consulting engineers: General Engineering Associates. General contractor: George W. Kane. Mechanical contractor: W. H. Sullivan Co., Inc.

Insurance company insures comfort cooling with GAS-operated CARRIER Absorption Refrigeration

The attractive new home office of Home Security Life Insurance Company in Durham, North Carolina, is as modern in personnel comfort as in its design. It is completely air conditioned with one of the most efficient systems available – Gas-operated Carrier Absorption Refrigeration serving 190 Modular Weathermaster* room units.



Good-looking machine room. Reflects up-to-date design of entire building. Here the gas-operated Carrier unit operates at 250-ton capacity to cool 575 GPM water from 52.5 F to 42 F, when supplied with 12 psig steam.

The Carrier absorption system is the essence of simplicity and economy. No prime mover is required. The energy source is low-pressure steam from a gas-fired boiler. Water is the cooling agent. Boiler capacity is put to use on a year 'round basis . . . cooling in summer, heating in winter. And thrifty gas keeps fuel costs low.

For comfort cooling at low cost, specify Gas and Carrier Absorption Refrigeration. Performance data and cost details are yours for the asking. Call your local gas company, or write Carrier Corporation, Syracuse 1, N. Y. AMERICAN GAS ASSOCIATION.

FOR HEATING & COOLING GAS IS GOOD BUSINESS!

*Reg. U. S. Pat. Off.

Highest Quality Water Filtration in large volume with SPARKLER DIATOMITE FILTERS!

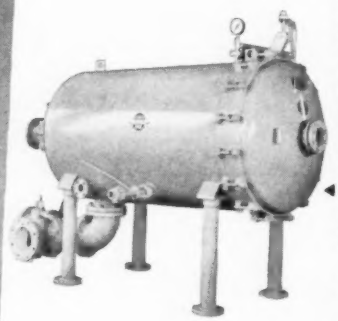
ALOYSIUS C. KRACKLAUER
Originator of the
Large Volume Diatomite Filter

Diatomite filtration of water in large volume is a comparatively recent development by Sparkler engineers. For many years the distinct superiority of diatomite filters in producing filtered water of highest clarity, with reduced bacteria count and with absolute uniform quality has been recognized by engineers in the chemical and other industrial fields, but old style diatomite filters were limited in volume.

Now the new large volume diatomite filters engineered by Sparkler have been tested in hundreds of successful installations in many industries and for municipal water supply, and have almost completely replaced sand filters for swimming pool filtration in schools, clubs, and municipal pools because of the greatly reduced chemical treatment necessary, to produce safe water.

This new phase of water filtration is worthy of careful investigation and study by all consulting engineers who are engaged in large volume water filtration.

MODEL RJ



A closed tank, pressure filter, with self cleaning features. The spent diatomite cake is peeled off the plates with the exclusive Sparkler Hydro-Scraper knife edge pressure spray and is washed out of the tank through the sloping bottom drain. The complete cleaning operation including precoating and recirculating for clarity ready for resuming operation is less than 30 minutes; a completely new uncontaminated filter media is thus provided. Filter element and spray tubes have no metal to metal contact with tank, thus providing electrolytic protection. Fully automatic electronic operation can be furnished.

Capacities are available in a single unit for 1,500,000 gal. per 24 hr. operation.

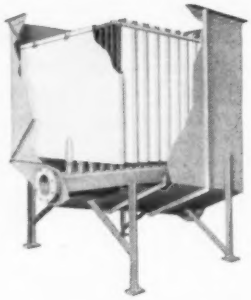
Approximately ¼ the floor space is required by this filter as compared with a sand filter and the installed cost is ⅓ to ⅔ that of sand.

MODEL HCV

A vacuum type filter that operates with an open tank and with full visibility of filtering process at all times. Plates are plugged into a self sealing outlet manifold at the bottom of the tank. Cake is removed by flushing off with hose. Spent cake flows out the self draining bottom through a T on the inlet supply pipe. Filter elements have no metal to metal contact with tank, thus eliminating electrolytic action.

This filter is available in capacities up to 900,000 gal. per 24 hr. operation.

Both filters have synthetic cloth covered plates that are removable without bolts or fastenings.



Write for bulletins and engineering data on these filters.

SPARKLER FILTERS

SPARKLER MANUFACTURING CO.
CONROE, TEXAS, U.S.A.

Sparkler International Ltd., Manufacturing Plants at Leliegracht 9, Amsterdam, Holland; Toronto, Ontario, Canada; Italy and Australia

FILTRATION ENGINEERING & MANUFACTURING EXCLUSIVELY FOR OVER 30 YEARS

to be conducted by the U.S. Public Health Service. At the end of the two-year research program, the Surgeon General is required to submit to Congress the findings which will be of marked interest to the entire nation. The study may be the first step toward a Federal smog-control law.

Boost in Highway Funds

The Federal government will have available $2.87 billion for payment of its 90 percent share of the interstate highway costs for the current fiscal year which started July 1. This will be only $170 million more than for fiscal 1960.

The Department of Commerce has put ceilings on the amounts each state may obligate in the new year if they are to be assured of prompt Federal reimbursement. Traffic now is moving over one-fifth of the planned 41,000-mile system (8855 miles). Some 4350 miles are under construction, with another 10,500 miles past preliminary engineering or right-of-way acquisition.

NAC Wants Highway Research

The Highway Research Board of the National Academy of Sciences insists that a new highway research program costing an additional $34 million during the next four years is vitally necessary. The Academy asserts that research is needed if the country is going to keep pace with an economy "utterly dependent" on its highway system.

Fields of study would include completely automatic highways, electronically guiding vehicles; traffic safety; better road building materials; and better maintenance. Research expenditures currently are running about $17 million a year.

Curb on Unions

The 1959 Landrum-Griffin Labor Reform Law is being used to curb some destructive union practices. In a ruling under the picketing

Longer Life! Superior Dependability!

THE ALLEN-BRADLEY LINE of BULLETIN 700 RELAYS IS COMPLETE!

TYPE B general purpose relay shown with 2 N.O. and 2 N.C. contacts. Made with up to 8 poles in various arrangements.

TYPE BX universal relay shown with 4 poles having both N.O. and N.C. contacts. Additional contacts on the 6 and 8 pole relays are N.O. only.

THESE IMPROVEMENTS ARE *IMPORTANT!*

These improved Bulletin 700 Type B and Type BX relays are establishing new standards for relay life and reliability. New design increases mechanical life by *at least 5 times* . . . a new contact motion insures *at least 10 times* greater electrical reliability. Double break, silver contacts never need maintenance, and the new molded coil is impervious to the most severe atmospheric conditions.

These new A-B relays—with their *extra millions of trouble free operations at no increase in price*—are a bargain in the relay field. Write for complete details, today.

A-B QUALITY

NEW ENCLOSURES

for the Bulletin 700 relays are styled by Brooks Stevens—internationally famous industrial designer. Note the "family" resemblance of these enclosures.

NEMA 1

NEMA Type 1 for general purpose applications with wrap-around cover for ready accessibility. It has a "quality" appearance.

NEMA 4

NEMA Type 4 enclosure for applications that require a watertight and weather-proof seal.

NEMA 7

NEMA Type 7 enclosure for NEC Class 1, Group D hazardous gas locations.

TYPE BR Bulletin 700 convertible contact relay shown with four poles. Made with up to six poles in line.

No other relay offers such simplicity in changing contacts from N.O. to N.C. (or vice versa)—it takes only 60 seconds!

A four pole unit provides any of the contact combinations otherwise available only with five relays of the fixed contact type. You can reduce your relay inventories. In tests, this relay has *proved* it will provide many millions of trouble free operations. Double break, silver contacts never need servicing. Also, each relay can have one or two complete and full rated contacts added to its base—in the field—without increasing space requirements. If you don't know about the Type BR relay, let's get acquainted.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 216 W. Greenfield Ave., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

section of the Act, the National Labor Relations Board says a union may not legally conduct peaceful picketing for recognition unless it files a petition for a government-conducted representation election within 30 days. It also maintains that picketing for "informational purposes" is illegal if it halts pick-up and delivery to the affected employer. The ruling grew out of a teamsters' union action in California.

Federal Urban Renewal

The oldest industrial area of the nation is New England. Therefore, official Washington has been watching with interest the Federal Urban Renewal Program in that region, which has 97 projects in various stages of completion. The program is designed to stamp out blight and salvage the decaying American city by making it vital once again. The costs are staggering, but urban renewal is reducing the costs of many services.

The Federal Reserve Bank of Boston reports that if the 1960s are to show progress in urban renewal in New England, the pace will have to be stepped up. The Bank says New England has $139 million authorized in Federal grants, and has applied for an additional $39 million. Local contributions toward renewal projects generally average 95 percent. This means that all of New England's renewal projects probably involve close to $3.5 billion in total expenditures. New England has 5.8 percent of the nation's population but 9.6 percent of the dollar amount of Federal urban renewal grants. A study of current New England projects indicates a total estimated cost of $4.8 billion.

Census Statistics

The greatest population growth of metropolitan areas during the 1950-60 decennial period took place in the areas of from 1/2 to 1 million persons. The surburban growth across the nation was the paramount story of the decade. Population in metropolitan suburbs grew by 17 million, accounting for almost two-thirds of the over-all population increase of 26.4 million. Three out of ten Americans now live in the suburbs.

Relatively little growth was chalked up in metropolitan areas of 100,000 or less, but the central cities of 100,000 or less increased faster than the areas just outside their city limits. Industrial development in the metropolitan areas from 500,000 up was greater during the past decade than among the smaller cities.

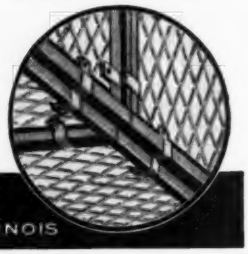
The Bureau of Census records show that the cities continued to be a great magnet, and the farm areas continued to decline. Examples of great suburban growth include the Baltimore area, which boasted a 72 percent suburban increase; and Washington, D. C., with an 86.6 percent suburban growth. The District of Columbia

GLOBE SAFE·GARD EXPANDED METAL
(FORMERLY HILMAR)
PARTITIONS with exclusive
QUIK-ERECT patented fittings

...will answer all your enclosure problems

Here is the new, easier, simpler method of guarding conveyors and machines and for all in-plant partitioning. Shipped READY for erection, no cutting, drilling or welding required . . . these interchangeable expanded metal panels provide greater safety, cut overall costs, cover a wider range of use and require 85% less storage space.

EXCLUSIVE QUIK-ERECT SECTION CLIPS save much of the erection time formerly required. Proven successful in hundreds of installations, these Safe•Gard panels are of welded construction, give longer life, are more rigid and stronger than wire, will not ravel or fray.



Note enlarged detail showing SAFE•GARD Quik-Erect Clips securely joining the interchangeable panels.

Write today for more details or call your Globe (Grip-Strut) Distributor.
Distributors in all principal cities, listed under "Grating" in your phone book.

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PRODUCTS DIVISION | THE GLOBE COMPANY
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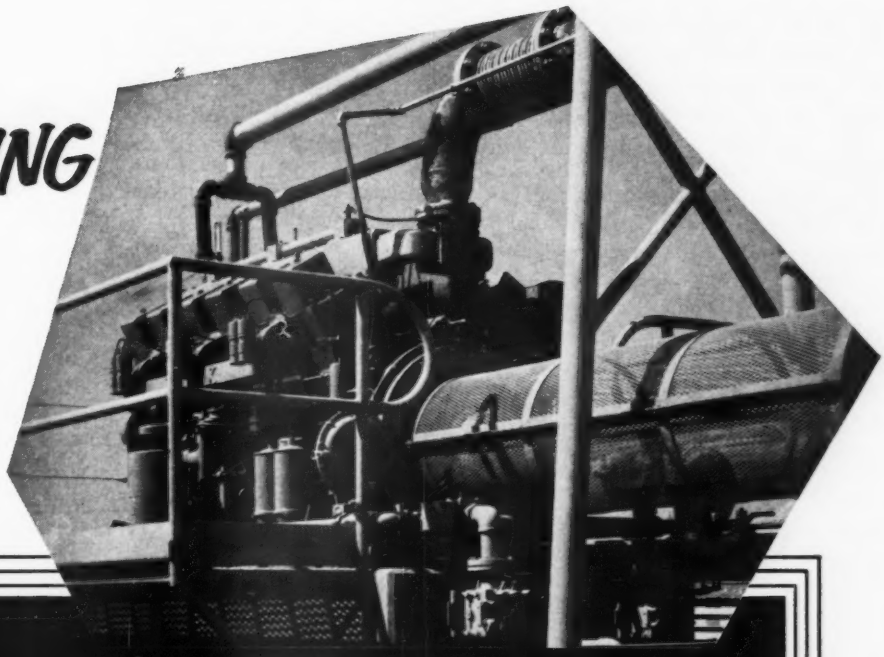
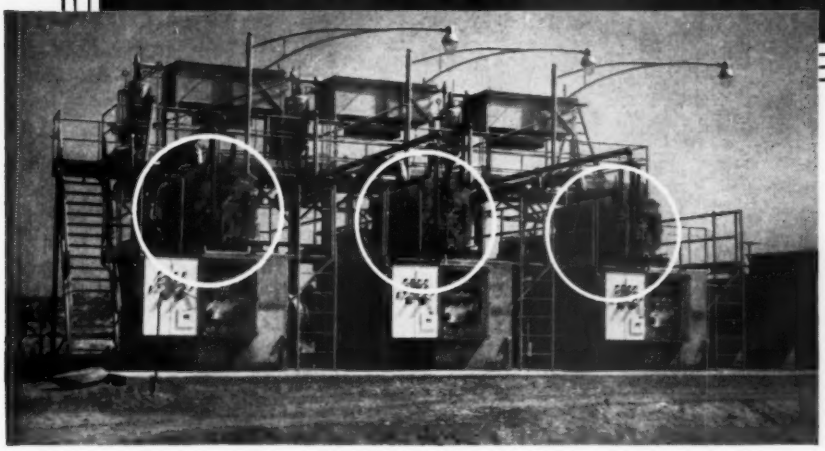
PROTECTING
outfall
basin
fluid
level



three CLIMAX V-122 ENGINES
power outfall booster pumps



At Orange County, California, Sanitation District, Plant 2, three *Johnson* vertical flow centrifugal type outfall booster pumps are powered by three V-122 *Climax* 3232 cu. in. engines: 12-cyl., 60° V-type, 7″ bore x 7″ stroke. Engines are equipped with ebullient cooling, full automatic starting and speed regulation; burn sludge gas, with natural gas for standby, and drive through *Western* BSV-144 right angle gears, ratio 2.1304:1.

In the Orange County treatment plant, ordinarily the treated sewage flows by gravity from the plant through a 3000 ft. long outfall conduit to the ocean. But an increased inflow to the plant, or a high tide, or a combination of both, causes the outfall forebay fluid level to rise. At a predetermined point Pump Unit No. 1 starts, warms up, then goes on the line. Further increases in fluid level bring Pump Units No. 2 and No. 3 into action, when necessary. The three Climax Engine powered Pump Units can handle maximum flow at the highest tide, and then some. With a decrease in outfall forebay level, the operation reverses—the units dropping off as need diminishes. For sewage treatment plants—seven rugged Climax Engine models . . . 12, 8, and 6 cylinders, burning sludge gas, or capable of operation on natural gas, butane, gasoline, or any combination . . . ranging from 100 hp to over 600 hp. Write for engine bulletins.

CL-118

CLIMAX ENGINE MANUFACTURING CO. • DIVISION OF WAUKESHA MOTOR COMPANY
FACTORY—CLINTON, IOWA

proper lost nearly 7 percent of its population. In addition to the District, only Arkansas, Mississippi, and West Virginia lost population.

Of the 225 central cities throughout the nation, 153 gained, and 72 lost (including San Francisco, which showed a drop for the first time since the gold rush).

Big California gained more residents during the past decade than other states, but booming Florida has the greatest percentage gain. Phoenix, Arizona grew from 106,818 in 1950 to 430,459 in 1960.

The first 20 cities (central), in order of their size are New York, Chicago, Los Angeles, Philadelphia, Detroit, Houston, Baltimore, Cleveland, Washington, St. Louis, Milwaukee, San Francisco, Boston, Dallas, New Orleans, Pittsburgh, San Antonio, Seattle, San Diego, and Buffalo.

Latin American Power

Expansion of electric power supplies in Latin America is under way at an accelerated rate. The World Bank is making new loans for this purpose in Peru, Honduras, and Nicaragua.

The Bank made a loan equivalent to $24 million to the Lima, Peru power company (Empresas Electricas Asociadas) for expansion of power in the area surrounding the capital of Peru. On this project, the consultant is Motor-Columbus Ltd, Baden, Switzerland.

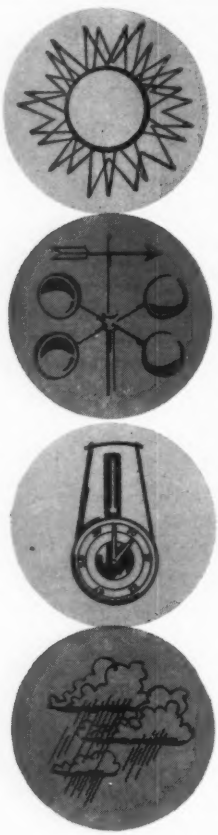
It also loaned $12.5 million to help finance construction of a 50,000-kw power plant and a 75-mile transmission line to bring power to Managua, the capital of Nicaragua, and to surrounding towns. An Italian firm, Electro-Consult, of Milan, is the consultant.

A third loan was made to help finance construction of a 27,000-kw hydroelectric power plant to expand facilities in Honduras, with Harza Engineering Co., of Chicago, serving as the consulting engineer. Empresa National de Energia Electrica, an autonomous agency of the government, was the borrowing agency. At present, its operations are confined to Tegucigalpa, the capital.

Long-Term Boycott Ends

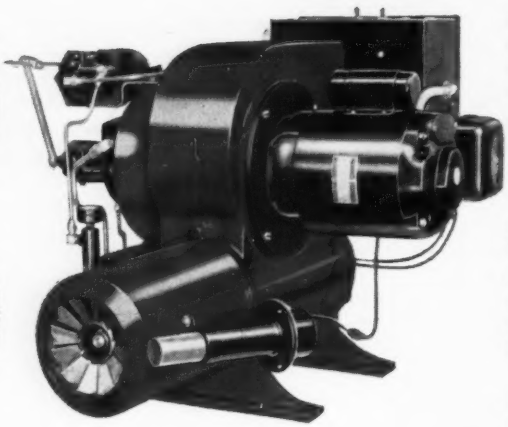
An end to union boycott activities which had been in effect for 15 years against an Ohio ventilating equipment maker was ordered by a unanimous decision of the National Labor Relations Board.

The case involved the Burt Manufacturing Company, at Akron, and the Sheet Metal Workers International Association, AFL-CIO, and three locals. The board found that the International and the locals had induced and encouraged employees of sheet metal contractors to refuse to install Burt products. Furthermore, the board directed the union organizations to cease trying to force Burt to sign a union shop contract with the Sheet Metal Workers unless Burt's employees first chose to be represented by that union. ▲▲



FOR HEATING AT ITS BEST
WHEN WEATHER DOES ITS WORST —

HEV-E-OIL BURNERS



Hev-E-Oil burners furnish all the air necessary for combustion, assuring perfect fire control under all weather conditions. Low fire start that builds up gradually to the flame size required means smooth, safe operation. And once the burner is set for greatest efficiency, it *stays* that way no matter what the weather.

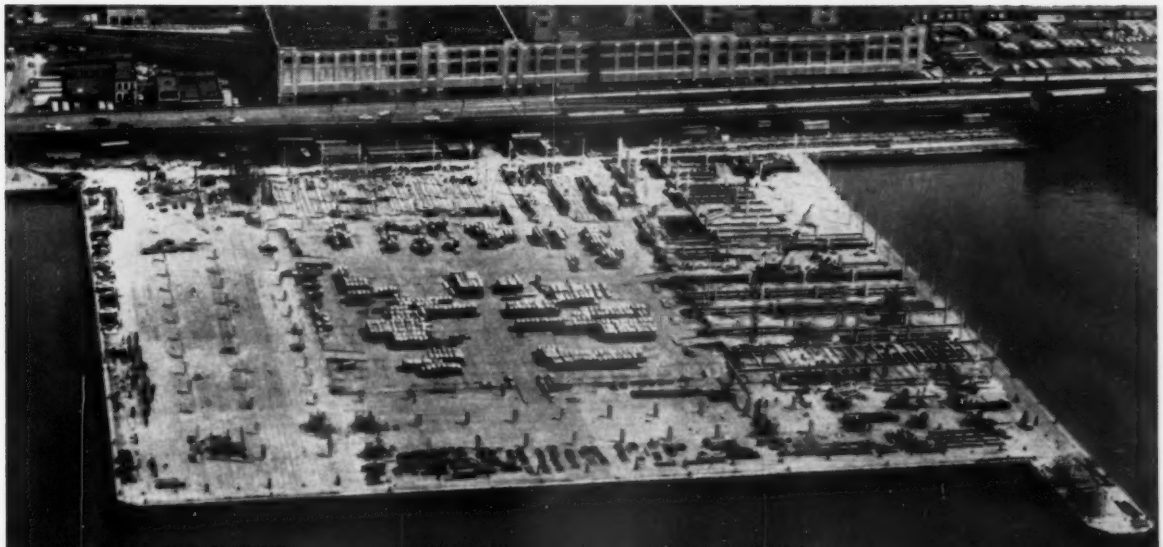
A complete package! Fire tested! Automatic, electronic controls. Meets all codes. Easy to install . . . Hev-E-Oil models from 5 to 150 gph. Also available, Hev-E-Duty power gas burners and combination gas/oil burners from 720,000 to 21,000,000 B.T.U.

For more information write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wis., Dept. CE-80.

INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4507 N. OAKLAND AVE., MILWAUKEE 11, WISCONSIN

Controlled Concrete with
SONOTARD
for New York's Largest Pier now under construction



Holland-American Line, New York City
Dept. of Marine and Aviation
Vincent A. G. O'Connor, Commissioner
Capt. Lewis H. Rabbage, Chief Engineer

Roberts & Schaefer Co.—Engineers
Stock Construction Corp.—General Contractor
Corbetta-Precrete—Prestress Contractors
Colonial Sand & Stone Co.—Ready Mixed Concrete

The substructure of new Pier No. 40 is comprised of 6000 prestressed deck slabs uniquely placed upon a monolithically poured-in-place beam and cap system. The floor area is over 700,000 sq. ft.

• **SONOTARD** is being used in *all* concrete to produce consistent and uniformly high strengths required for the heavy live loads to be handled, plus maximum density to resist erosion from sea water.

• A high degree of workability to facilitate placement has been maintained through high summer heat and a winter which recorded a low mark for sustained cold weather.

• The quantities of **SONOTARD** used were varied according to temperature to keep the water content and rate of hardening constant. At all temperatures **SONOTARD** produced a uniformly high strength with maximum density and eliminated shrinkage and cracking.

• **SONOTARD** played an essential role in the prestressed deck slabs and beams by controlling the initial rate of hardening and fluidity of concrete for optimum placement properties.

• **SONOTARD** speeded the strength development (15 hours of steam cure averaged over 4500 psi) permitting early release of tension and early stripping of forms.

• Since **SONOTARD** does not increase the air content while reducing water requirements it allows the operator to control accurately the total air at all times.

Consult your local SONNEBORN representative for your particular project to learn how **SONOTARD'S** exclusive formulation can help you produce harder, denser floors—more uniform, crack resistant structures—water-tight concrete of minimum shrinkage.

Product of
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Research

SONNEBORN CHEMICAL AND REFINING CORPORATION
Building Products Division, Dept. C-80
404 Park Avenue South, New York 16, N. Y.

Gentlemen:

Please send further information on SONOTARD.

☐ Engineer ☐ Architect ☐ Contractor

Name.....

Company.....

Address.....

City.....**Zone**.....**State**.....

NOW YOU CAN GIVE YOUR CLIENT SAFER, FASTER, LONGER-

Anaconda Durasheath has a new clean-stripping, semi-conducting tape

The megohm meters (above) are measuring the surface resistivity on two samples of high-voltage, rubber-insulated, Shielded and Neoprene-jacketed cable immediately after the semi-conducting tape has been removed. The sample on the left (with a megohm meter reading in excess of 100 megohms) is Anaconda Durasheath incorporating the exclusive clean-stripping, semi-conducting tape. For comparison, the cable on the right with a low reading typifies old-style cable manufactured with ordinary semi-conducting tape.

The old-style cable requires tedious surface filing and buffing before it is clean of conducting particles, and ready for the tape build-up necessary to complete the splice or termination. Even after all these preparations, the surface may still be conducting because of the semi-conducting particles remaining deeply imbedded in the insulation.

New Anaconda Durasheath eliminates the need for excessive filing and buffing. Because the semi-con tape strips clean, the bared Durasheath insulation surface is left with only slight traces of easily

"Meggers"—courtesy James G. Biddle Co., Philadelphia, Pa.

LASTING JOINTS AND TERMINATIONS ON HI-VOLTAGE CABLE

removed semi-conducting particles. The meter readings will show that a moment of buffing is all that's needed to complete surface preparation for tape build-ups and the most reliable splice or termination possible today.

The planned research and production program which brings you this outstanding cable development is also responsible for the equally important developments in Butyl rubber insulation compounding, and extruding, which have produced the best possible balanced design and construction in high-voltage rubber-insulated cable obtainable today—Anaconda Durasheath.

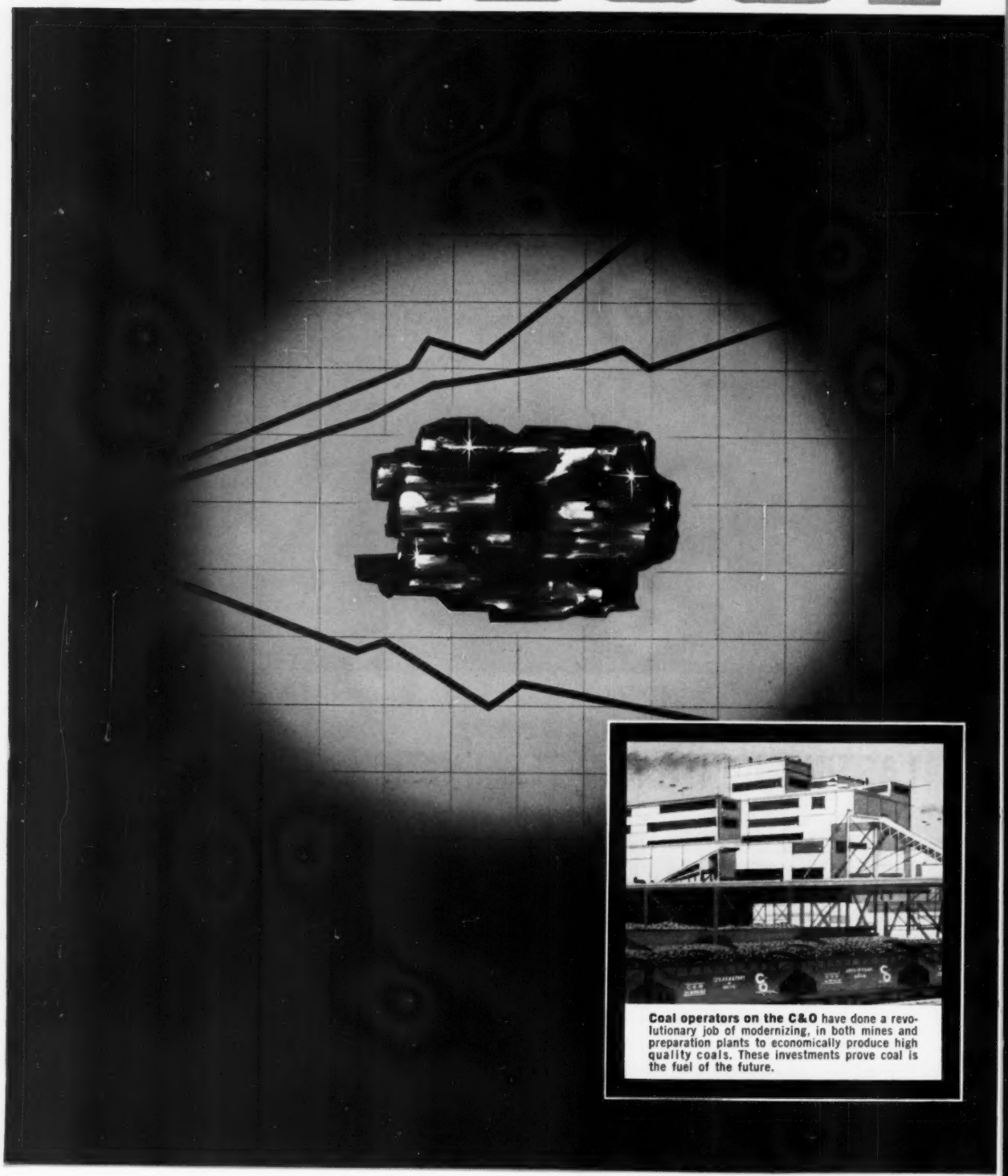
To make specifying Anaconda Durasheath easier and more confident, write for Anaconda Bulletin, DM-5903, covering Durasheath High-Voltage Cable and DMS-5566, 5720 and 5735, dealing with the splicing and terminating of Durasheath Cable. Contact your nearest Anaconda Wire & Cable Company District Office, or write to 25 Broadway, New York 4, N. Y.

ASK THE MAN FROM

ANACONDA®

ABOUT DURASHEATH® CABLE

REDISCOV



Coal operators on the C&O have done a revolutionary job of modernizing, in both mines and preparation plants to economically produce high quality coals. These investments prove coal is the fuel of the future.

ER COAL !

COAL IS ECONOMY– proved in countless studies with competitive fuels

As forward-looking fuel users continue to *rediscover coal,* a growing file of case histories proves out the economy, versatility and convenience of coal utilized with modern combustion equipment. Here are a few graphic examples.

A sprawling university undergoes plant modernization, upgrades heating efficiency 75%. Coal saves a military institute $15,041 yearly over competitive fuel. A machine shop saves $7,787. Coal conversion gives a small tool plant completely automatic operation at lowest cost. An automotive assembly plant reports not only fuel economy but low maintenance, high efficiency and cleanliness as well, from its new coal operated steam plant.

The point is this. Modern advances in coal preparation, handling and combustion equipment have vastly improved the advantages of this biggest bargain in fuel. Today it is mined and transported more economically than ever. And coal is the one fuel certain for *centuries, not decades.*

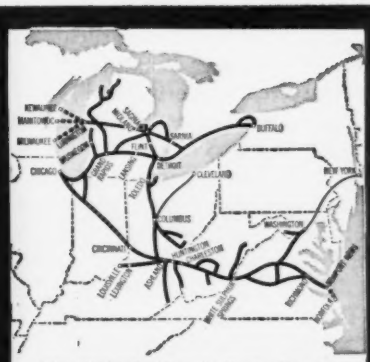
Chesapeake and Ohio Railway

Terminal Tower • Cleveland 1, Ohio

Outstandability in Transportation

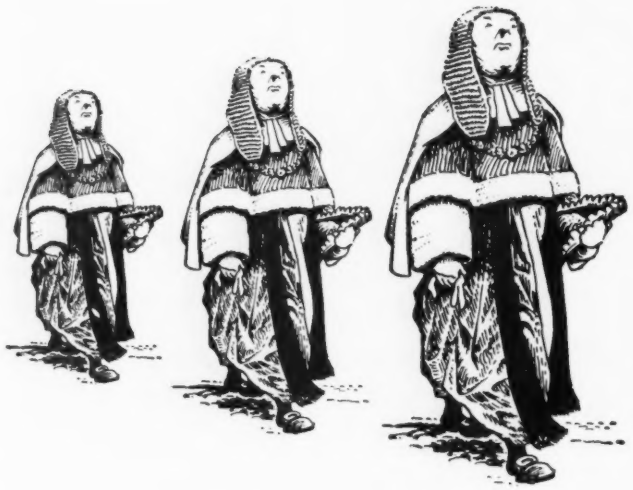
A modern boiler room in pastel colors has a clean, almost clinical appearance. Automatic sealed handling of coal and ash eliminates dust. Advance-design combustion equipment gets top BTU's from low cost coal.

C&O Fuel Service Engineers provide free consultation to C&O patrons on combustion, application, equipment, or plant arrangement problems. Write to R. C. Riedinger, General Coal Traffic Manager, above address.



The 5100-mile Chessie Route directly serves over 300 mines in America's richest bituminous coal reservoir with the finest fleet of 68,000 coal cars. Specify C&O routing for dependable, efficient delivery.

CHESSIE SERVES THE COAL BIN OF THE WORLD



The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

Conditions of the Contract: Changes and Extras in the Work

THE "Conditions of the Contract" forms of the Consulting Engineers Council (CEC) and the International Federation of Consulting Engineers (FIDIC) contain provisions relating to changes in the work and extra work, which vary substantially from each other. It is worthwhile to consider the similarities and differences in these important respects.

Changes in the Work

The CEC form (Sec. 2.6.04) provides simply that "The owner may, as the need arises, order changes in the work through additions, deletions, or modifications without invalidating the contract. Compensation and time of completion affected by the change will be adjusted at the time of ordering such change." (This section is exclusive of another section for "extra work," i.e., "new and unforeseen items of work found to be necessary.")

There are some places in this provision where possible ambiguity lurks, for example, "as the need arises." Presumably this expression means that the owner cannot, as of right, make changes in the work which are merely "desirable."

By comparison, the FIDIC form (Sec. 51) says "The engineer shall make any variation of the form, quality, or quantity of the works or any part thereof that may in his opinion be necessary and for that purpose *or if for any other reason it shall in his opinion be desirable* shall have power to order the contractor to do and the contractor shall do any of the following: (a) increase or decrease the quantity of the work included in the contract; (b) omit any such work; (c) change the character or quality or kind of any such work; (d) change the levels lines, position, and dimensions of any part of the works; and (e) execute additional work of any kind necessary for the completion of the works . . . no such variation shall in any way vitiate or invalidate the contract but the value (if any) of all such variations shall be taken into account in ascertaining the amount of the contract price." (We have supplied the italics.)

It should be noted that while the CEC provisions as to changes in work and extra work appear to be limited solely to "necessary" variations, the FIDIC provisions (excluding extra work) apply to either "necessary" or "desirable" variations. The FIDIC provisions as to changes in work are extremely broad in scope; they appear to make it possible for the owner to abandon the entire project, for example, without breaching the contract. On the other hand, the CEC provisions appear to be reasonably narrow in scope. However, the exact meaning of the language used is not very clear in either document, and yet this provision goes to the very heart of the contract, i.e., what work the contractor is to do.

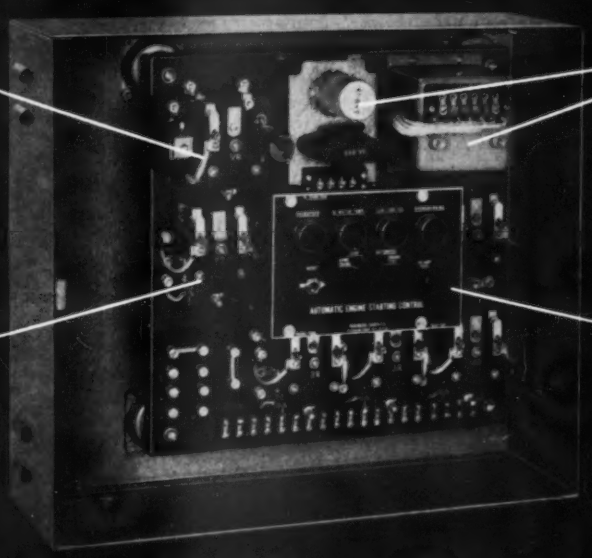
Neither the CEC nor the FIDIC form is very explicit in regard to what corresponding adjustment is to be made in compensation for changes in work. The CEC form simply says "Compensation and time of completion affected by the change shall be adjusted at the time of ordering such change." How this is to be accomplished is not elucidated. Evidently, it is intended that the owner and contractor shall agree on these matters, but an "agreement to agree" is legally a nullity. It does not appear that this is an arbitrable matter either, because under Sec. 2.3.04 of the CEC form, only decisions of the engineer are subject to arbitration. Thus, the whole matter of changes in the work and adjustments in compensation therefore seem to be in extremely nebulous form. Of course, it is very difficult to know how to be specific about such matters, but it is also very desirable to find some way to head off such basic disputes, if a suitable formula can be invented for this purpose. Such a formula actually is used in the CEC form with

ONE OF A SERIES: ASCO Complete Emergency Control Systems put Standby Power in action FAST

Unique crank disconnect relay prevents recranking at full engine speed.

Heavy Duty Industrial Components provide dependable, rugged service.

Positive Response Relays do not require critical adjustments or frequent maintenance.



Inverter-Timer Combination assures constant cranking periods despite wide variations in battery voltage and ambient temperature.

Link Connections provide manual or automatic shutdown of engine.

Indicating lamps, fuses, and manually operated switches are integral part of control panel... eliminate wear on cables when door is opened... make unit suitable for switchboard applications.

ASCO Engine Starting Controls offer...

extra protection for your standby power equipment!

ASCO Engine Starting Controls provide fully automatic starting and stopping of diesel or gas engine driven generating sets. They offer the extra protection of a unique disconnect relay which positively prevents recranking while engine is running at full speed... helps eliminate danger of damage to starting gears. And control operation is fast... only 1/30th of a second!

Here are other important benefits of new ASCO Controls:

ASCO FEATURE	YOUR BENEFIT
Controls designed to respond at 50% of normal battery voltage.	Assures starting even after high cranking current reduces battery voltage.
Operates over broad ambient temperature range.	Can be installed in unheated areas of plant.
Repeated or continuous cranking cycles provided by same panel.	Makes unit adaptable to all engines.
Industrial control type components throughout.	Provides rugged, sure service, not possible with light duty components.
Motor driven timing device.	Assures accurate control of timing cycles—unaffected by temperatures or other variables.
Can operate from single pole contact on automatic transfer panel or control station.	Reduces installation time and costs.
Coded terminals.	Eliminates guesswork in connecting engine and starting panel; simplifies installation.

ASCO Electromagnetic Control

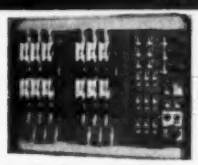
ASCO

Automatic Switch Co. 50CC HANOVER RD., FLORHAM PARK, N. J., FRONTIER 7-4600

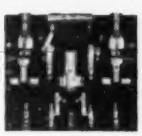
AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

For additional information write for Catalog 57-S6.

OTHER ASCO CONTROL SYSTEM COMPONENTS:



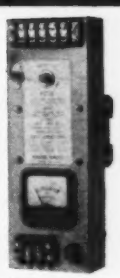
Automatic Transfer Switches *for all classes of load to 750 volts AC-DC. Transfer connected load to standby power when failure or substantial reduction occurs. Return load automatically when full power is restored—in sizes from 10 to 1200 amps. Write for Catalog 57-S1.*



Load Demand Controls *automatically start engine when load is applied; stop it when load is removed. Write for Catalog 57-S6.*

Solenoid Valves *for air starting applications, and for controlling the flow of cooling water, fuel oil and other liquids and gases. Write for Catalog 25.*

Solenoids *for fuel control devices, operating shutters for engine cooling, and other electric plant applications. Write for Catalog 57-S5.*



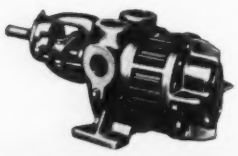
Battery Chargers *for heavy duty industrial use keep engine generator cranking batteries fully charged. Charger can be combined with automatic transfer panel for compact, single package arrangements. Write for Catalog 57-S6.*

WHATEVER YOUR REQUIREMENTS FOR ROTARY PUMPS, THERE'S A ROPER TO DO THE JOB

Series T .3 to 55 GPM
Choice of 192 Models

Pump and motor units . . . pump serves as end bell of motor. Require minimum space . . . easily installed . . . no coupling required . . . mount in any position. Each unit approximately same size as NEMA motor of HP required for driving. Open drip proof or totally enclosed motors; single or three phase as required.

ROPER
ROTARY PUMPS



Series F 1 to 300 GPM
Pressures to 300 PSI

Feature helical steel pumping gears, hardened steel shafts, bronze flange-type bearings. 4-port design with 8 optional piping arrangements (4 for CW and 4 for CCW rotation) solves installation problems. With or without built-in relief valve in either mechanical seal or packed box construction.

ROPER
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Series K ¾ to 50 GPM
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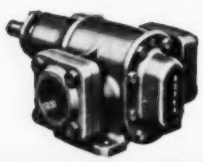
Extremely compact in all sizes. Helical pumping gears are hardened steel, with steel shafts and bronze bearings. Sizes 10 through 50 GPM have patented venturi suction and discharge principle for smooth flow and quiet operation. With or without built-in relief valve; packed box or mechanical seal.



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Designed to operate at direct motor speeds. Used for all types of hydraulic mechanisms where high pressures are required. Hardened steel spur gears for maximum efficiency, and heavy duty roller bearings and bronze wear plates for long life service. Mechanical seal or packed box.

ROPER
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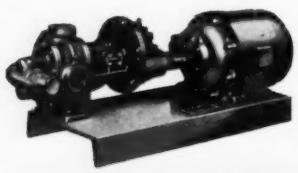
Series 3600 40 to 300 GPM
Pressures to 100 PSI



Handle thick or thin liquids at slow speeds. Operate in either direction. Hardened iron pumping gears, hardened steel shafts, heavy duty bronze sleeve bearings. Mechanical seal or packed box. Series includes tank truck pumps as well as single motor driven units with gear reduction.

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Send for
"How to Solve Pumping Problems"

Roper Hydraulics, Inc. COMMERCE, GEORGIA
Manufacturers of Standard, Special and Custom Pumps for All Industries

respect to extra work, but there is no formula for other changes in the work.

The FIDIC form, on the other hand, is fairly specific as to how "such variations shall be taken into account in ascertaining the amount of the contract price." A formula is provided in Sec. 52, with these principal provisions:

¶ The engineer shall determine the amount (if any) which in his opinion should be added to or deducted from the sum named in the tender in respect of any extra or additional work done or omitted by his order. All such work shall be valued at the rates set out in the contract if in the opinion of the engineer the same shall be applicable. If the contract shall not contain any rates applicable to the extra or additional work then suitable prices shall be agreed upon between the engineer and the contractor. In the event of disagreement the engineer shall fix such prices as shall in his opinion be reasonable and proper.

¶ Where, in the engineer's opinion, the nature or amount of the change renders the rate contained in the contract unreasonable or inapplicable, then the engineer and the contractor are to agree on a suitable rate or price, or if they cannot agree, the engineer sets a reasonable and proper rate or price.

¶ There are provisions for getting these decisions in writing as quickly as practicable.

¶ If the change in the work results in more than 15 percent change in the contract price, this is in any event subject to agreement between the engineer and the contractor; failing agreement the engineer sets a reasonable and proper price, "regard being had to all material and relevant factors including the contractor's oncosts and overheads."

¶ Any dispute in these matters is subject to arbitration.

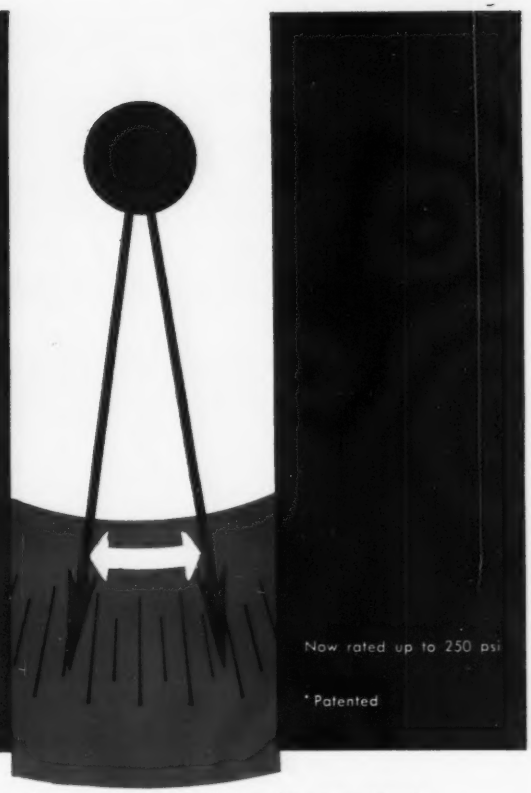
The CEC form is also vague as to the form by which the owner may order the contractor to make

NEW

MULTI-ZONE

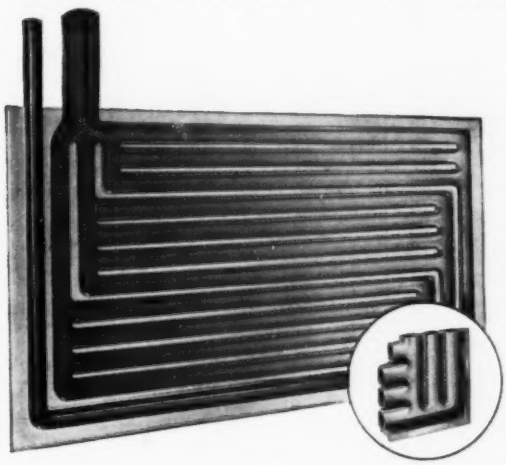
PLATECOIL®

FASTER START-UP, CONSTANT TEMPERATURES



The new MULTI-ZONE design cuts "downtime" and compensates for intermittent overload in a wide range of tank and process heating applications. Multiple headers and multiple condensate returns provide for FREE-FLO action — with practically instantaneous distribution of steam to all levels of the plate. Condensate "trapping" is held to a minimum. This gives the new MULTI-ZONE PLATECOIL a reserve capacity to deliver under overload conditions during "start-up." It also produces extremely fast recovery of tank temperature with minimum variation.

IN ALL KINDS OF TANK AND PROCESS HEATING



Operating Pressures up to 250 psi — DURAWELD bonding of the plates and mill-controlled TRANSTEEL in standard units have boosted PLATECOIL pressure containment rating up to 250 psi. This makes the time-proven advantages of PLATECOIL applicable to many types of heating where 250 lb. steam is required. Destruction tests have demonstrated a safety factor of 5 to 1.

Low Installation and Maintenance Costs. — PLATECOIL costs are low compared to the cost of engineering, fabricating, installing and maintaining pipe coils. Lightweight, compact PLATECOIL simplify installation. Greater heat transfer per sq. ft. of surface permits smaller units which save valuable tank space. Streamlined surfaces cut cleaning costs. Integral, factory fabricated construction eliminates threaded joints (in the solution) to corrode or leak. All stainless steel and alloy PLATECOIL units affected by cold working are annealed and pickled after fabrication to return the metal to its original condition and thus eliminate the probability of corrosion due to internal stresses and carbide precipitation.

Write for NEW Bulletin P85 for complete data.

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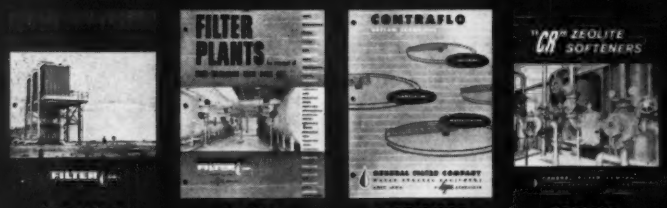
PLATECOIL® DIVISION

NEW BULLETINS on treatment of WATER, SEWAGE AND INDUSTRIAL WASTE



AERATORS | FILTER PLANTS | CLARIFIERS | ZEOLITE SOFTENERS

AERATORS—Describes aerators for oxidation of dissolved iron and manganese, and for elimination of odors and gases. Explains and pictures forced draft aerators, pressure aerators and atmospheric aerators.

FILTER PLANTS—Lists problems of untreated water and offers solutions. Explains and pictures four basic water treatment methods for elimination of turbidity, minerals, gases, organic matter, and for pH correction.

CONTRAFLO UPFLO CLARIFIERS—Pictures and describes five basic Contraflo types for water softening and clarification. Explains application for industrial waste neutralization and recovery processes.

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C2

changes. For example, it is not specified that a written order is needed, nor that it must come from the engineer, in the event of changes in the work (as is the case with extra work).

On the other hand, the FIDIC form treats the method of ordering changes in the work and extras both in the same way, i.e., "No such variation shall be made by the contractor without an order in writing of the engineer." The FIDIC form then goes on to provide that if the order of the engineer is verbal, the contractor must comply anyhow and if it is subsequently confirmed in writing, this counts as a "written order." If the engineer fails to confirm it in writing, the contractor himself confirms it in a writing to the engineer, and if this is not contradicted in writing, it is deemed a sufficient "written order." This is fine, so far as it goes, but what happens if the engineer does contradict it after the change has been made by the contractor? The contractor was required to comply with the order, and now if the engineer denies it (or amends it) the contractor is out on a limb. Of course, such a dispute can be subjected to arbitration (under FIDIC Sec. 67), but this still seems rather unfair to the contractor. However, it is at least more certain than the CEC method, which is no method at all regarding changes in the work.

Extra Work

The FIDIC provisions treat extra work in exactly the same way as changes in work, except in one respect. As indicated in the language quoted from Sec. 51 of the FIDIC form, any changes in the work which the engineer deems desirable can be made without breaching the contract, but extra work can only be ordered if it is "necessary for the completion of the work" (Sec. 51e).

On the other hand, the CEC form apparently limits both changes and extras to those which are neces-

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Quiet, vibration-free performance is essential when motors are installed in areas where noise must be held to a minimum . . . in hospitals, churches, schools, office buildings, restaurants and similar locations where quiet is needed or wanted.

Such installations have created a need for larger polyphase motors that whisper while they work. Wagner has met this need by expanding its line of polyphase resilient mounted motors to include standard ratings through 10 hp.

You certainly have applications that call for a smooth running motor, cushioned by resilient mountings. To make sure they're quiet, specify Wagner Polyphase Resilient Mounted Motors. Only Wagner can provide an entire range of ratings through 10 hp.

Constant research and development have kept Wagner up front in electric motor design for more than 65 years . . . made the name Wagner one you can depend on in choosing electric motor drives.

Your nearby Wagner Sales Engineer can help you select the right motor to meet your requirements. There are Wagner branch offices in 32 principal cities.

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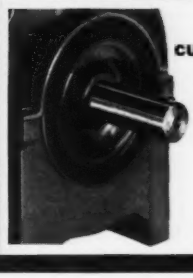
SLEEVE OR BALL BEARING

These motors are furnished with quiet running steel-backed babbitt-lined sleeve bearings of high load carrying capacity. Ball bearings can be supplied when desired.

CEILING, SIDEWALL OR HORIZONTAL MOUNTING

You can mount these motors on walls or ceilings by rotating the cradle base 90° or 180°. Motor stays dripproof.



NEOPRENE CUSHIONING RING

Annular mountings, of oil-resistant neoprene bonded to steel rings, cushion the motor in its cradle base to absorb the small amount of vibration that remains in the most carefully balanced motor.

Engineering advances in Cleaver-Brooks CB packaged boilers (15-600 hp) offer every plant engineer and boiler owner greater efficiency, simpler maintenance

1. **Controls** and control panel all mounted on front head for operator convenience.

2. **Front head hinged** (or davited) to provide quick access to flues for cleaning and inspection without disconnecting fuel or electrical lines.

3. **Quiet operation** is result of radial blade, cast aluminum blower deep in front head with acoustically treated air inlet.

4. **Rotary air damper** modulates air for high combustion efficiency. Offers vibration-free control of air for positive draft.

5. **Cam operated fuel valves** driven by rugged linkage insure accurate, easy to adjust air-fuel ratios for highest combustion efficiency.

6. **Single tip retractable nozzle** simplifies cleaning since nozzle can be completely removed from firing position without opening front head or disconnecting oil or electrical lines. Single tip burner nozzle offers close-to-ideal mixing of air and fuel.

7. **Inspirating pilot** produces and maintains a pilot at zero gas pressure.

The new CB boilers up through 600 hp with an integrally-built air atomizing burner, atomize both light and heavy oils (including No. 6 oil). Oil is burned like gas — cleanly and completely. Every CB boiler meets four design standards—*four pass—forced draft* construction — *five square feet of heating surface* per boiler horsepower — *low furnace* location. For the complete design story, write Cleaver-Brooks Company, Dept. J, 321 E. Keefe Ave., Milwaukee 12, Wis.

Cleaver Brooks®

ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

sary. However, since changes in the work under the CEC form are apparently entirely a matter of negotiation between the owner and the contractor, there is no reason why they cannot agree on changes which are merely desirable.

Regarding extra work, the CEC form is more specific, and it actually is limited to necessary extra work. Thus, in practical effect it appears that under the CEC form, changes in work need be merely desirable, while extra work must be necessary. If this is so, it will be seen that this is the same as that provided in the FIDIC form, despite the fact that, on the face of it, the FIDIC form appears to allow "desirable" changes and extras, and the CEC form appears to allow only "necessary" changes and extras. Unfortunately, this conclusion is largely a matter of deduction (or guesswork), and it would be preferable to have more clarity in both forms. It is also questionable whether there is any good reason for having these particular distinctions between "changes" and "extra work," particularly since they are so haphazardly contained in each form.

Authorization

While the FIDIC form requires a written order from the engineer for both changes and extra work, the CEC form is substantially blank in this respect as to changes, but quite specific as to extra work. Sec. 2.6.05 provides: "New and unforeseen items of work found to be necessary and which cannot be covered by any item or combination of items for which there is a contract price shall be classed as extra work. The contractor shall do such extra work and furnish such materials as may be required for the proper completion or construction of the whole work contemplated upon written order from the owner as approved by the engineer. In the absence of such written order, no claim for extra work shall be considered . . . Extra work

Here's How KENNEDY'S Union Bonnet and Cylindrical Body Simplify Installation and Increase Valve Life...

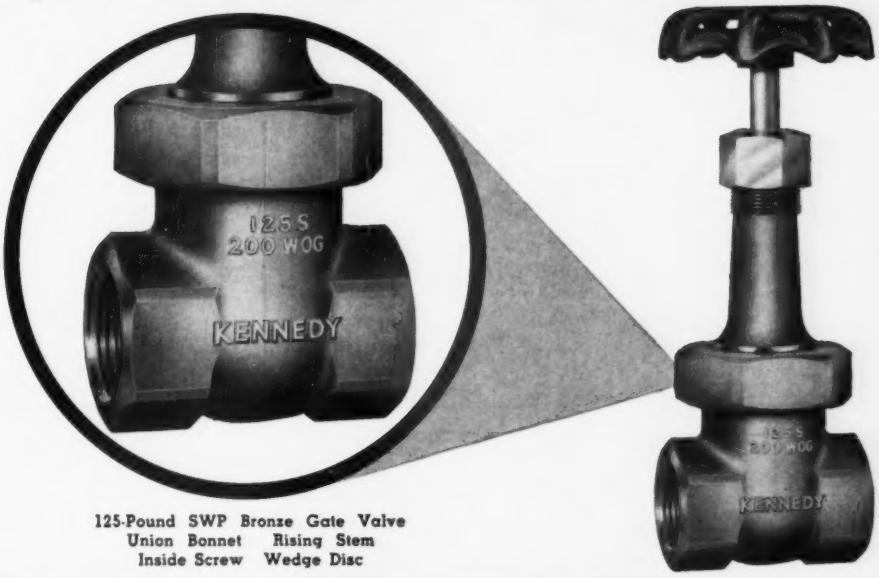
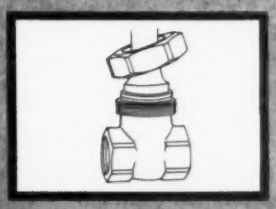
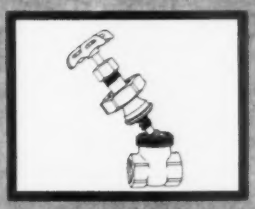


Fig. 525

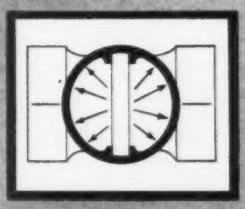
125-Pound SWP Bronze Gate Valve
Union Bonnet Rising Stem
Inside Screw Wedge Disc



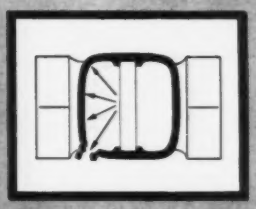
Kennedy's Union Bonnet permits repeated dismantling for cleaning or inspection and reassembly without danger of distortion of the valve. The bronze-to-bronze construction makes a tight union for tight, leakproof operation.



Kennedy's Fig. 525 can be easily disassembled into component parts for installation in otherwise inaccessable places in existing lines or for new installations.



Kennedy's cylindrical body construction when under severe pressure resists rupture and minimizes deflection thus preventing leakage at the seat.



Pressure in ordinary non-cylindrical valve bodies tries to push the body wall out to form a circle or cylinder. Rupturing stresses concentrate where wall has the shortest radius. Resultant deflection causes leakage over disc and early failure.

These additional advantages make KENNEDY your best valve buy...

Rugged, wider hex ends, blended into body, prevent distortion. On a conventional valve body, hex ends protrude from the body and are connected by thin body wrists. This area under severe wrench pressure, can distort and cause disc seating trouble. Kennedy's wider hex ends are blended into the body making the body and hexes one unit. In this way wrench pressure can be absorbed.

Newest in the valve field . . . best in the valve field . . . Fig. 525 gives greater strength with less bulk and weight than any comparably rated valve.

Kennedy's Fig. 525 can be repacked under pressure, eliminating line shut-downs. You simply open valve fully, remove packing nut and then repack.

• *YOU CAN'T BUY A BETTER VALVE THAN A KENNEDY!*

KENNEDY VALVE MFG. CO.

ELMIRA, NEW YORK

VALVES • PIPE FITTINGS • FIRE HYDRANTS

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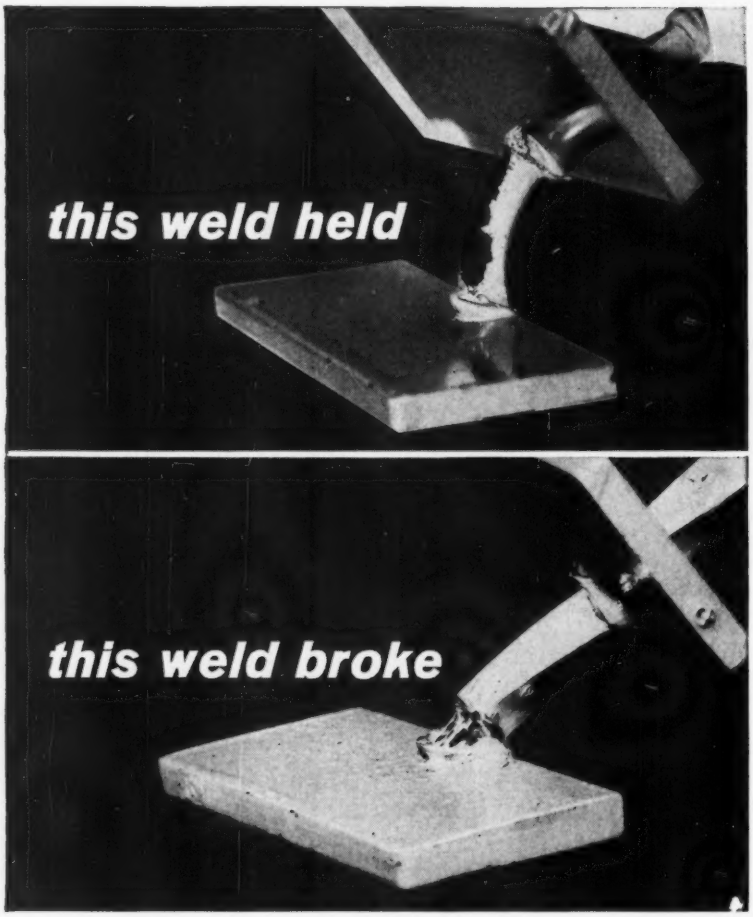

(Above) This DRAVO TRU-WELD GRATING was deliberately bent, placing far more strain on the welds than there would be in normal service. Not a single weld has parted. This grating will withstand vibration and hard usage.

(Below) **Bent in exactly the same way,** this grating came apart at the welds. The fusion of bearing bar to cross bar achieved by the Dravo method of manufacture prevents this from happening to Tru-Weld Grating.

the new stronger grating is

TRU-WELD

Tru-Weld grating is stronger because it is *made* that way. Its added strength comes from a manufacturing process that completely fuses the metal at cross bar-bearing bar joints and holds the bars to exact spacing. The result is grating that stands up under excessive vibration, heavy traffic or in areas where corrosive fumes and moisture are a problem. And Dravo Tru-Weld grating *costs no more.*

Complete estimating, layout and fabricating services are available. Immediate delivery from stocks maintained at nearby Joseph T. Ryerson Service Centers will help you meet exacting construction schedules.

For more information on this new, stronger grating — call the Dravo representative in your area, or write Dravo Corporation, Pittsburgh 25, Pa.

DRAVO
CORPORATION

required in an emergency to protect life and property shall be performed by the contractor . . . "

Aside from the last sentence quoted (which is clearly a valuable provision, but which is rather vague as to the need for a written order, in order to be compensable), this is a model of simplicity, accuracy, and fairness to all parties, and seems to be a distinct improvement over the corresponding provisions of the FIDIC form.

As to compensation for extra work, the FIDIC formula is the same in this respect for changes and for extra work, and the CEC form is also fairly specific. Sec. 2.7.10 provides that the contractor must give written notice of any claim for payment for extra work within 10 days after receipt of instructions for such work and "before any work is commenced, except in emergency endangering life or property. No claim shall be valid unless so made." The CEC form then goes on to provide that the owner's order for extra work shall specify one of the following methods of payment:

¶ Unit prices or combinations of unit prices which formed the basis of the original contract.

¶ A lump sum based on the contractor's estimate, accepted by the owner, and approved by the consulting engineer.

¶ Actual cost plus 15 percent for overhead and profit.

The fact that this claim for extra work normally is filed by the contractor before starting extra work is unquestionably a very good idea, since it may head off troubles before they start. But the CEC form is not clear as to what happens if the owner is not satisfied with the contractor's claim. It is not entirely clear whether the contractor still must go ahead or not, whether the owner must "take it or leave it," or whether the dispute is subject to arbitration (as this is not a decision of the engineer, under Sec. 2.3.04). These ambiguities should be cleared up. ▲▲

have trouble specifying heating and air conditioning from ten different firms?

* one way to solve your problems is with . . .

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☐ Unit heaters
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(Industrial direct-fired space heaters)
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Unit heaters

These unit heaters are ideal for supplementary heating such as heating loading dock and storage areas. They range in size from 80,000 to 250,000 Btuh.

GSDI duct heater

The GSDI duct heater can be used with existing duct systems as added heat or can be used as a forced air space heater when connected to a blower. Available from 120,000 to 420,000 Btuh.

"Landmark"

The Lennox "Landmark" is extremely versatile, because of its modular design. Ideal for heating and cooling smaller areas or, if used as multiple units, capable of handling larger areas. Air conditioning is an integral part of the Landmark system.

Lennox oil "Stowaway"

Where space is at a premium and capacity demands not too great, the Lennox Oil "Stowaway" line is an ideal solution. These units range in size from 119,000 through 350,000 Btuh.

OG4 industrial heaters

Here is the "big boy" of the Lennox line...the OG4 combination gas-oil industrial heater. Lennox industrial heaters have a range from 280,000 through 2,000,000 Btuh. Lennox industrial heaters can be installed either vertically, horizontally or inverted.

Air conditioning

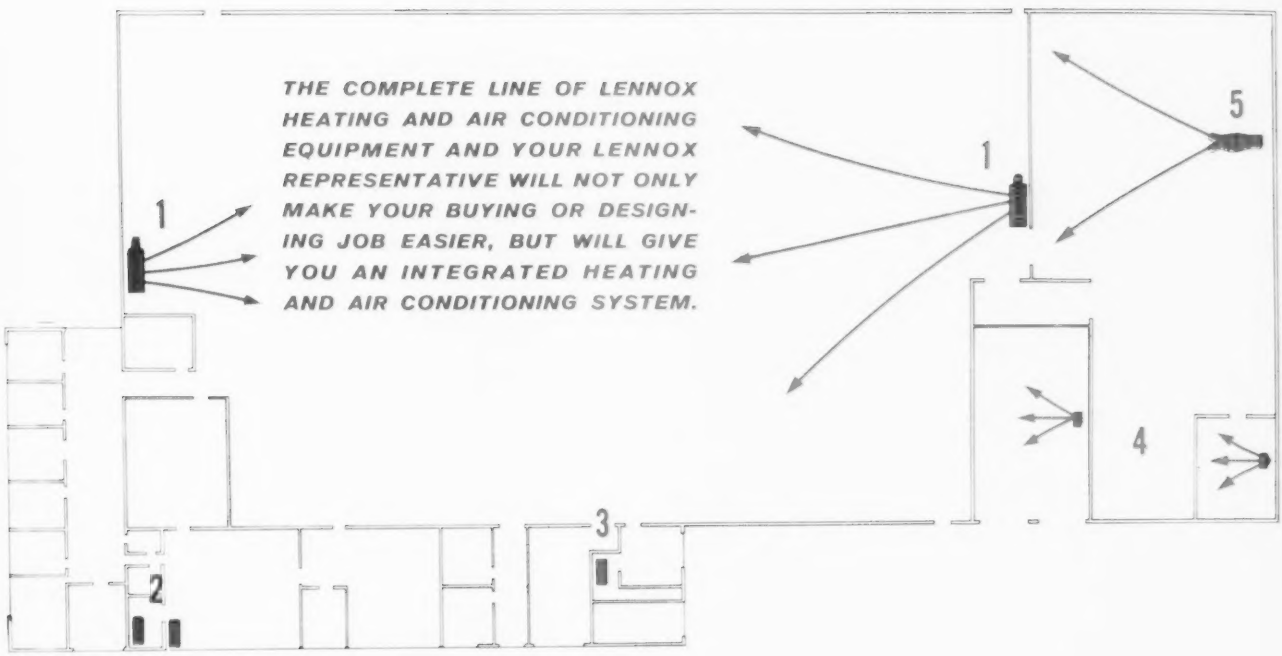
Lennox Air Conditioning has been designed to work as an integrated part of the various heating units. Seventeen-ton condenser shown here is but one of the many units in the extensive Lennox line of air conditioning equipment.

These are just a few of over four hundred units in the extensive Lennox line of heating and cooling equipment.

There's no guess work or "make do" with Lennox equipment . . . This broad line of equipment meets every heating and air conditioning requirement. In the New York plant shown here, for instance, several types of heating and cooling problems faced the engineers. Each area in the plant had its own heating and cooling peculiarities and needs. By utilizing several types of Lennox models, each problem was solved easily. The results: properly sized units that deliver top heating and cooling at a sensible cost.

- direct-fired vs "wet" industrial heating
- heating and air conditioning
- make-up air and ventilation
- process work
- space heating

THE COMPLETE LINE OF LENNOX HEATING AND AIR CONDITIONING EQUIPMENT AND YOUR LENNOX REPRESENTATIVE WILL NOT ONLY MAKE YOUR BUYING OR DESIGNING JOB EASIER, BUT WILL GIVE YOU AN INTEGRATED HEATING AND AIR CONDITIONING SYSTEM.



(1) Two Lennox OG4 Industrial Heaters, delivering a total of 1,260,000 Btuh, heat 10,600 sq. ft. of manufacturing area. Although air nozzles are installed here, ductwork can also be used if the job conditions require it.

(2) Two Lennox "Landmark" heating and cooling units supplying a total of 238,000 Btuh, 12 tons of cooling maintain year around comfort in 4,800 sq. ft. of office area. Supply ducts are located in concrete slab with outlets at perimeter.

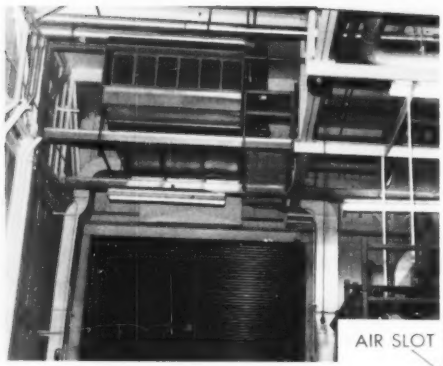
(3) A third Lennox "Landmark" unit heats remote supply and mailing areas.

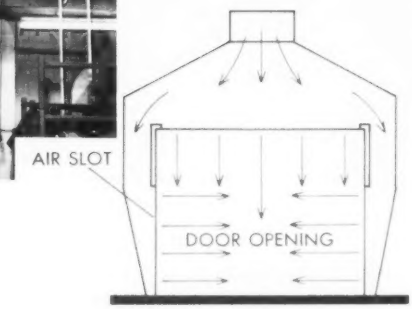
(4) Two Lennox gas heaters add supplemental heating to loading and storage areas.

(5) Single Lennox gas duct heater with a Lennox packaged blower suspended from the ceiling heats 7,000 sq. ft. with 420,000 Btuh. Cooling may be added if desired.

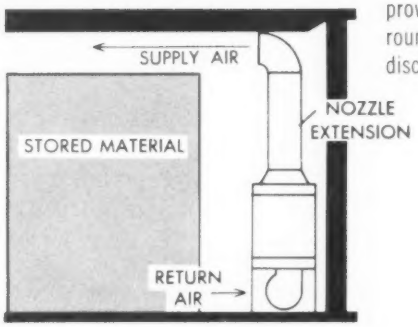
LENNOX

industrial heating and cooling equipment

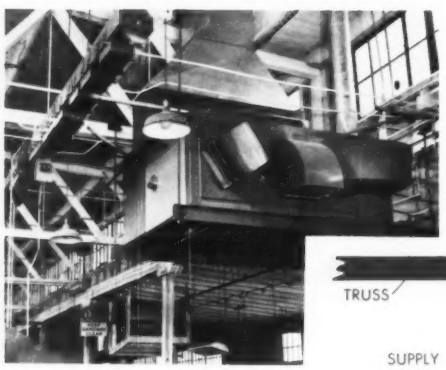


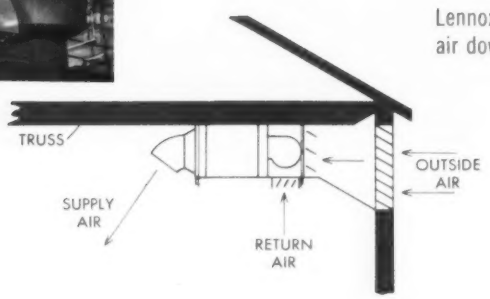


A problem frequently encountered in industrial heating is the infiltration of cold outside air into a heated space through large loading doors that are in frequent use. The most successful method of preventing the entrance of this cold air into the heated space is to surround the doorway with slot openings through which heated air is discharged at a velocity sufficient to blanket the opening. Note the line drawing and picture illustration of this method of heating.



Another problem encountered in various plants and warehouses are buildings used for storing materials. The volume of stored material leaves only aisleways and clearance from the pile to the roof line to circulate heated air. A simple and inexpensive solution to this problem is to provide air nozzle extensions which are simply round pipes that elevate the heated air stream discharge above the height of the stored material.





If floor space is unobtainable for the location of direct-fired space heaters, the next best thing is to suspend the units from the ceiling.

Lennox industrial heaters are available with service platforms for suspension purposes.

Lennox blowers are sized to push the heated air down to the work area where it belongs.

LENNOX Industries Inc.

MARSHALLTOWN, IOWA • COLUMBUS, OHIO • SYRACUSE, N.Y. • FORT WORTH, TEXAS • LOS ANGELES, CALIF. • SALT LAKE CITY, UTAH
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FORM NO. IND.-601-M2

"Quote . . . End Quote"

The Reader's Digest Version

". . . Mismanagement is evident, too, in the extravagant use of private engineering consultants, instead of state highway employees, in designing projects. Such practice is in violation of Federal policy, and it runs into money. The General Accounting Office has found that the costs of Pennsylvania's contracts with private consultants for preliminary engineering alone have been averaging $1 million a month. In New Jersey, in less than four years, eight engineering firms have received $8,219,967 in consultant fees for interstate projects. In Maryland, consultants have received more than $24 million on Federally-aided highways since 1954.

"Usually a consultant is paid a percentage of the cost of the project on which he works. He has a great deal to do with deciding whether the job will be an expensive one or a frugal one. Thus only a highly developed sense of ethics stands between him and temptation. While rich old Uncle is tossing money around, the temptation to cash in on a large scale is frequently great and sometimes irresistible." — *The Reader's Digest*, July 1960.

And Some Rebuttals

". . . any inferences that a few isolated cases prove that the entire program is rotten with recklessness, extravangance, special privilege, thievery, etc., is a great disservice to the great majority of sincere and honest individuals and firms involved in the work and should be so recognized . . ." — Paul Robbins, executive director of *NSPE*.

"The article by Karl Detzer, which appeared in the July 1960 issue of *Readers' Digest*, make some very damaging statements regarding the Federal highway program. He may, or may not, have had sound background for his statements.

"In his 7-page article, he devotes two paragraphs to the condemnation of consulting engineers, without in any way demonstrating that the use of their services has been unwise or uneconomical. He implies corruption, and he most certainly needs to be informed on the true facts. I hope that, through his own initiative, he may be persuaded to correct the impression which he has erroneously created.

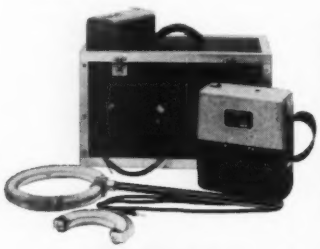
"The major part of Mr. Detzer's article criticizes decisions and performance by public employees, which, if anything, would strengthen the argument that the use of competent, ethical consulting engineers could be extremely helpful." — R. H. Tatlow III, president of *AICE* to CONSULTING ENGINEER.

Education of Engineers

"There has been a lot of debate on the question of science versus engineering as an art, primarily as the result of the tyranny of words in information releases on atomic and missile projects. Most of the scientists involved in these projects are in fact practicing engineering, with various degrees of competence, and the engineer without a sound grounding in mathematics and science is badly prepared for the practice of engineering in this age. The days of both the universal scientist and the so-called practical engineer are gone and will not return. Modern projects and component design elements commonly involve combinations of the several engineering disciplines and require thorough education of the engineer in mathematics and basic sciences. For example, all engineers are now commonly involved to some degree with electronic components and circuitry. Similarly, man in space is involved with some first-order problems of guidance and geodesy. Modern practice requires not only greater appreciation level knowledge of the several engineering disciplines but greater specialist knowledge and greater awareness to seek and accept the advice and collaboration of specialists in particular categories. It is reasonable for other engineers to assume that the civil engineer will have a workable knowledge of the several geophysical sciences — a field he has neglected for many years. Similarly, it is reasonable

FOUR WAYS TO INSURE GOOD COATING PROTECTION

Continuity is all important in a protective coating. Whether it's a 90 mil coating on a pipeline or a 3 mil coating on a chemical tank, a tiny pinhole can lead to the destruction of the coating. Use of a Tinker and Rasor Holiday Detector will quickly locate pinholes as well as weak spots caused by air bubbles, coke, rust or scale. Minutes spent inspecting with a Tinker and Rasor Holiday Detector while the job is open can save days of down time later on.



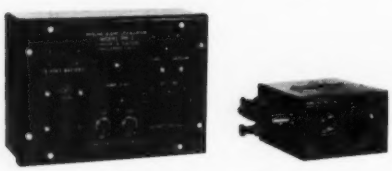
Pipeline Detectors

E-P For damp or dry surface, high electrical resistance coatings. Output adjustable from 8000 to 20,000 pulsating voltage. Electrodes available: half circle, spring for pipe to 6", full circle to 30" silicone brush for flat surfaces.

E-4 This lower cost type of detector is specifically designed for smaller diameter pipe and flat surfaces with dry surface, high electrical resistance coatings. Output adjustable from 8000 to 20,000 D.C. voltage.

Thin Film Detector

M-1 For painted or sprayed thin film coatings. Maximum applied voltage 67½ V., non-destructive to coatings. Belt mounted, 4 lbs. total wt.



Underground Pipeline Detector

P-D For detecting holidays, electrical contacts or locating the pipeline itself, **without uncovering the pipeline.** Completely transistorized — long life and light weight.

Engineering Note:

Every protective coating specification should include TR Holiday Detector inspection. Write for specification guide.

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Quality Control for Coating Application

TR TINKER & RASOR

417 Agostino Road, P.O. Box 281 • San Gabriel, California

for the civil engineer to expect the electronic engineer, the physicist, and other specialists to contribute to the advancement of surveying and photogrammetric instruments and procedures. No apology need be made for these contributions which reflect only good practice in the use of the common body of scientific knowledge and the collaboration of specialists." – Max O. Laird in a speech to *ASEE*.

What Shortage?

"All of us know that in a free economy the price a certain commodity demands is determined by the law of supply and demand. When the supply is great, the price is low; and when the supply is short, the price is high. Since the relative price an engineer in industry can demand is not high, it follows that the shortness of the supply cannot be too acute.

"The hue and cry that engineers graduating with a BS degree get higher paying jobs than all other BS graduates is true. This is quite an inducement for people entering college to choose engineering as a profession. The fallacy is that little is said about what happens to an engineer's salary as he gains experience. In only five years, the salesman's salary, on the average, will exceed the engineer's, and in 10 years the accountant's average salary will surpass the engineer's, as will that of those in many of the other fields of endeavor. For this reason, many of our top engineers are turning to management and sales to realize the monetary rewards they seek.

"Perhaps instead of trying to entice an ever-increasing number of people into the engineering profession, we should devote a part of our effort toward making the profession one that will retain a greater number of the more capable people who enter it. One way to do this would be to utilize large numbers of technicians and engineering assistants to relieve the engineer in industry of many of

Here's maximum FLEXIBILITY of CONTROL

in a complete SUPERIOR package

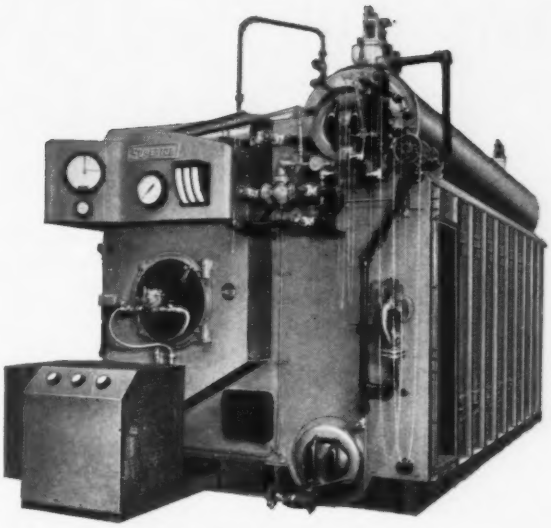
PNEUMATIC *or* ELECTRIC METERING *or* POSITIONING CONSOLE *or* PANEL

Combustion controls tailored to your operation and completely integrated in a Superior Packaged Boiler provide a combination that's hard to beat.

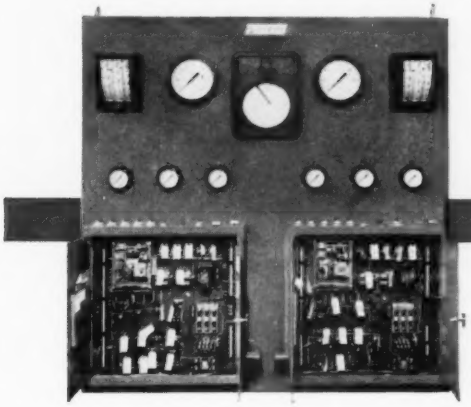
Electrically operated positioning controls for steam or rotary burners are supplied either in console arrangement or free standing panel. Metering controls, either electrically or pneumatically operated, are supplied with steam atomizing burners of all capacities in free standing panels which may be individual for each boiler or combined for two or more boilers.

Safety combustion controls are an integral part of every control panel. Complete factory wiring terminates in a boiler junction box with terminal strip matching identical strip in control panel.

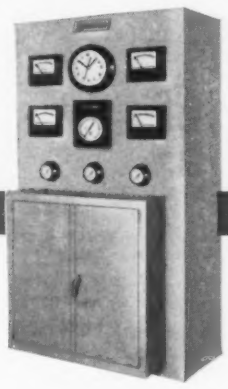
For complete data on Type D Boilers write for catalog D-13



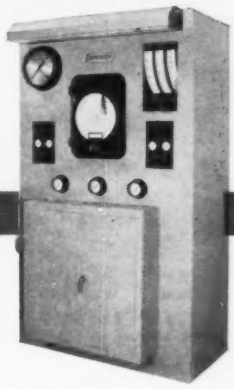
"Type D" Superior Packaged Boiler with integral console for single burners and electric positioning controls.



Duplex panel for two boilers with recording, indicating instruments and individually wired cabinets for combustion safeguard controls.



Control panel with indicating instruments for either rotary cup or steam atomizing burners with positioning controls.



Control and instrument panel with pneumatically operated metering controls for steam atomizing burner installations of all capacities.

Specialists in PACKAGED BOILERS... exclusively

SUPERIOR COMBUSTION INDUSTRIES, INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR PACKAGED BOILERS

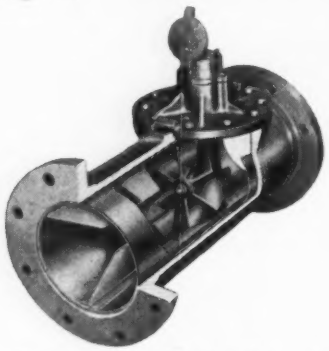
SPARLING METERING TOPICS

Propeller Meters With Full Pipe Size Bore Cut Head Loss

Negligible head loss eliminates the need for pressure recovery equipment.

This is one of the many advantages of propeller type meters in main-line service. The straight bore of the Sparling meter assures uninterrupted flow, regardless of flow rate or pressure variations.

A further contributing factor to low head loss is the propeller. Molded of tough, resilient plastic with a specific gravity of .93, it literally "floats" in the line and rotates on self-flushing, anti-friction bearings which are virtually drag-free.

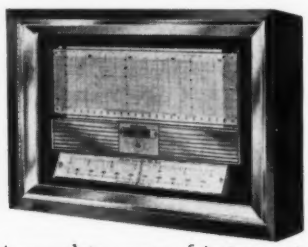


Pressure loss with Sparling meters 8" or larger is less than 3" of water at average rated velocities.

INSTALL IN ANY POSITION...Propeller meters function with the same high degree of accuracy in any position—horizontal, vertical, or on an angle—and can be placed in either pump suction or pump discharge piping.

ACCURACY...Sparling propeller meters are guaranteed accurate within 2% of true flow at all flows within the rated range of the particular meter. Each meter is tested and then individually geared and calibrated to maintain consistent accuracy.

DIRECT TOTALIZATION...The primary function of a propeller meter is totalization. Reading is direct without the need of conversions or additional computations. Sparling propeller meters register total flow on a 6 digit straight reading totalizer in any standard volumetric unit desired. If instantaneous rate of flow information is also required, an Indicator-Totalizer can be installed on the meterhead which gives continuous data on both volume and velocity.



A complete range of instruments is available for use where readings are to be made at locations remote from the meter itself.

LOW MAINTENANCE...Moving parts are few in a propeller meter and close-tolerance manufacture gives many years of accurate, trouble-free operation. Periodic lubrication and inspection is usually all the maintenance required. When further service is needed, the entire metering unit is easily lifted out of the line with minimum shut-down time.

METERS FOR EVERY NEED...There is a complete line of Sparling meters, instruments and controls to meet every main-line metering need. Sparling equipment has been proved in nearly half a century of use in cities across the country and around the world.

Ask your Sparling field engineer for complete information, or write direct for Catalog 315-CE.

SPARLING WATER CONTROL EQUIPMENT

HERSEY-SPARLING
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Sparling Equipment: EL MONTE, CALIF.
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his nonengineering tasks, and then pay the engineer more for doing work of higher engineering content.

"We must continue to publicize the profession and to urge capable and talented young people to become engineers and scientists. We should not, however, concentrate our efforts to preach a 'shortage of engineers' to the point where many young people who are neither capable nor talented are enticed into a very exacting and demanding profession." — *The Engineer*, Syracuse GEEA, October 1959.

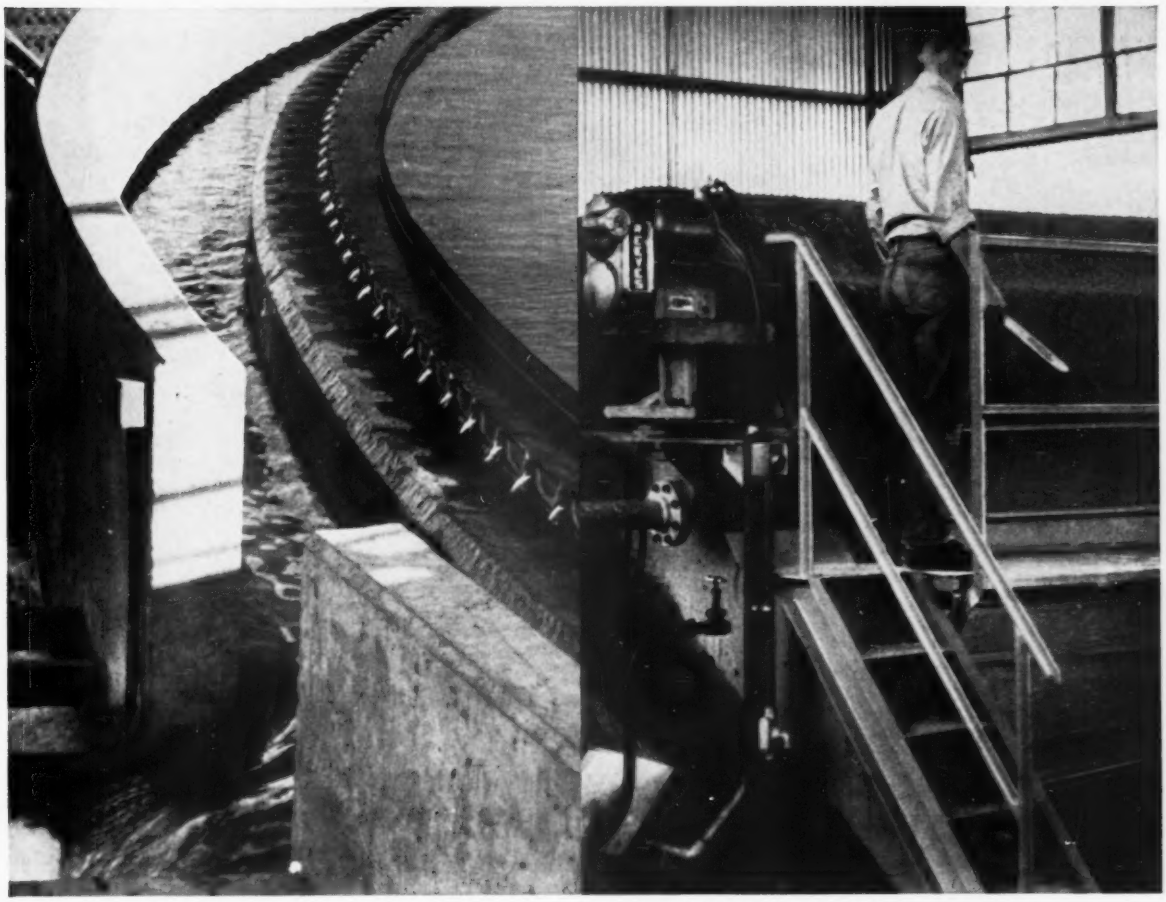
Monorail System Unsound?

"Owing to the lack of any central agency for transit research, and the inability of the average transit operation to finance any well-organized research for the whole industry, whenever a crew of monorail promoters has moved into an area it has usually been necessary for the authorities responsible to either ignore the proposals or to retain engineering consultants to conduct an investigation and evaluation of the proposals made.

"The vast majority of recent monorail proposals are quite devoid of any basic novelty — indeed, because of the age of the monorail art, such novelty is highly improbable. In Europe, there is an international organization for transit problems, and this has studied monorail in the past and is no longer devoting much time to this activity. Here, we have repetitious studies by various consultants, and each metropolitan area has to do the job over and over. In view of the record of many exhaustive studies, and the rejection of monorail as a type of rapid-transit construction, it may be suggested that this represents a waste of public funds and engineering effort, insofar as reconsideration of old features is concerned. Proponents of monorail should be required to show what new features, if any, are offered.

"The proof of a negative is notoriously difficult. Yet since the mono-

HOW DIAMOND GARDNER SOLVED EFFLUENT PROBLEM AT NEW PLANT *and won approval for site near river bank*



Clean water from Dorr Clarifier flows down aeration ladder on way to settling basin.

Sludge from Clarifier is pumped to Oliver Vacuum Filter for dewatering prior to disposal.

Diamond Gardner's new integrated forest products plant at Red Bluff, Calif., is a model installation for complete utilization of the timber harvest.

Before this model project could get off the drawing board, the company had to provide a plan for disposing of plant effluent that would win state approval.

The efficient waste treatment plant, designed by the company engineers, uses Dorr-Oliver equipment. Effluent from pulp and molding processes flows to a Dorr Clarifier, where flocculants are metered in. The resulting water flows down aerating stairs en route to a three-compartment, 9¼-acre settling basin.

Sludge recovered from the Dorr Clarifier is fed to an Oliver rotary drum Vacuum Filter designed to operate either as a precoat unit or with roll discharge.

Dorr-Oliver has a wealth of experience and diversified equipment to solve waste disposal problems. Write to Dorr-Oliver Incorporated, Stamford, Connecticut.

DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

It's true they existed, though you may not recall . . . the 'good ole' days of the one hoss shay, gas lights, pistol packin' mamas and McGinty's—where red eye, pink garters and black magic ruled the roost. Yes sir, the boys really whooped it up when Igor the Marvelous plied his talents with trick cards, disappearing lassies and similar quicker-than-the-eye hocus pocus.

But nowadays, another type of legerdemain has caught the public's fancy. It's KAUL Presto-SEAL clay pipe with factory-molded precision-cast polyester spigots and sockets that ***joint like magic.*** A rubber gasket, permanently imbedded in the socket, where it belongs, is the key to this pipe joining wizardry. When installed Presto-SEAL is completely impervious to root penetration, and performance standards are far above the most rigid infiltration-exfiltration requirements.

Engineers, contractors and public works officials throughout the country have been loud in their praise of this revolutionary improvement for sewage and drainage systems. On job after job—on any terrain—even under water, it's been proved that KAUL Presto-SEAL clay pipe is trouble free under exacting tests . . . can be laid faster . . . saves upwards to 50% in time and labor costs.

Want to be shown? Ask for free demonstration, a trial Presto-SEAL installation, or write now for complete specifications.

Manufactured to A.S.T.M. Specifications,
Presto-SEAL is available in a complete range of sizes
from 4" to 36", both standard and extra strength, with matching fittings.

*T.M. Reg.

KAUL clay company

TORONTO, OHIO • U. S. A.

"Exclusive manufacturer of Presto-SEAL pipe that joints like magic"

rail proposal is primarily one of a geometrical nature, there is little room for any probability that new construction methods or new materials can make any difference or secure any advantages that cannot be applied to any system of rail geometry.

"The disadvantages of monorail are many, and in the judgment of the majority of qualified and responsible engineers these outweigh any advantages." — William H. T. Holden, Pasadena consulting engineer, at the *ASME* Dallas meeting.

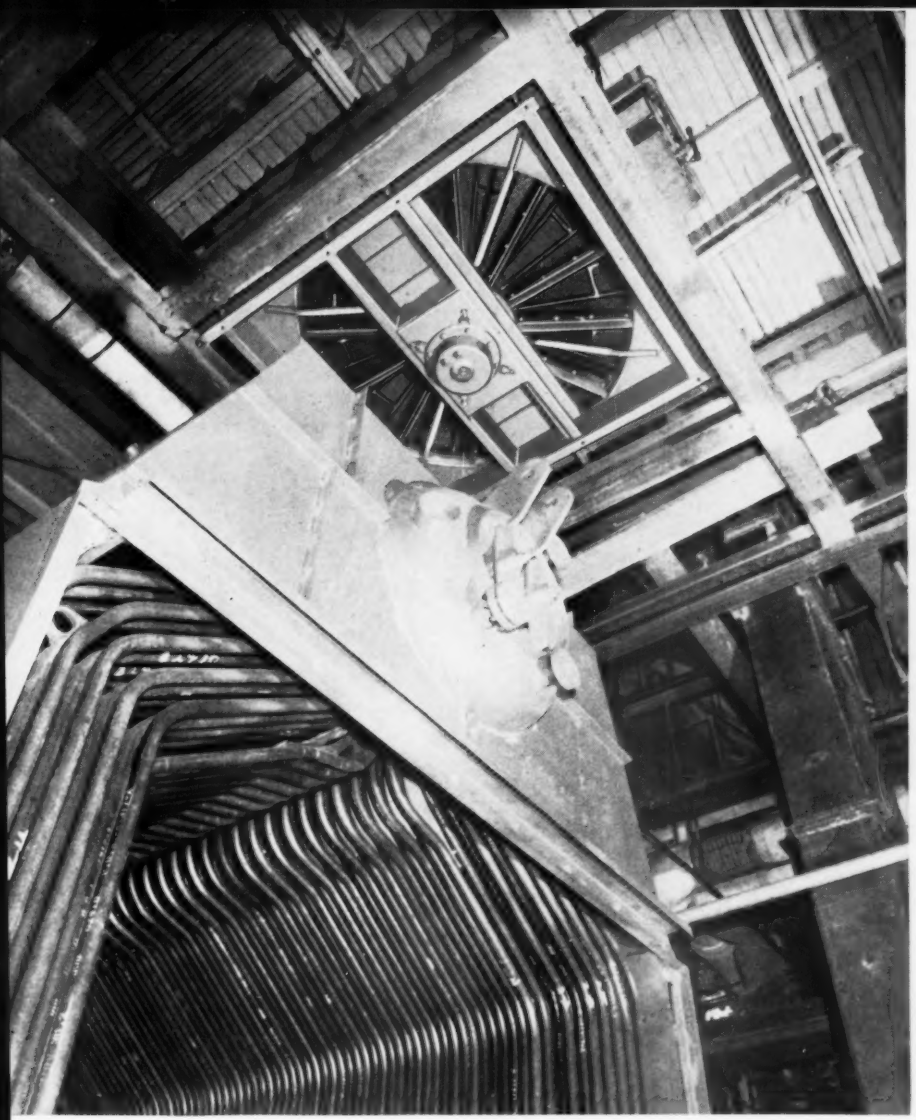
New Sound and Vibration Lab

"Accurate measurement and the subsequent control of sound and vibration [in air conditioning equipment] will aid in giving the user quieter, longer lasting equipment and systems. In addition, we expect that our findings will be of use to the various associations, societies, and organizations now endeavoring to establish standards for the measurement of sound in our industry.

"Although our research and development along these lines is directed primarily toward continual improvement of our own equipment, we are anxious to see a practical and useful standard of measurement and interpretation adopted that can be used throughout the industry — by manufacturers, architects, and consultants. This would help eliminate much of the confusion and dissatisfaction resulting from the use of various proprietary indexes, scales, and assorted numbers, many of which are virtually meaningless at the point of application." — Henry M. Haase, president of the *York Division of Borg-Warner Corp.*

Professional Organization

"Ever since the world began, man has engineered ways of facilitating the business of living, and long before the distinction of professional status and legal recognition were bestowed on him, the engineer was trading his particular skill



The Ljungstrom Air Preheater at the B. F. Goodrich Company Shelton Plant is installed directly over the 65,000 lb/hr Wickes boiler. Flue gas leaving the boiler at 615°F passes through the circular rotor, which absorbs the heat and releases it into the incoming air. Preheated combustion air improves combustion, makes fuel burn cleanly. This Package Air Preheater was factory-assembled, and requird only 100 manhours to install.

At B. F. Goodrich Co.'s Shelton Plant

Air Preheater boosts combustion air temperature 345°F... gives 6% more thermal efficiency

"Only a Ljungstrom® Air Preheater, with its continuous regenerative principle, could meet our requirements", says A. G. Sandomirsky, Manager of Engineering at the B. F. Goodrich Company, Shelton, Conn., plant. "We produce foam rubber 24 hours a day, five and six days a week. With an Air Preheater we can meet process steam requirements more economically, and an Air Preheater helped us to justify the installation of high efficiency, high pressure equipment for by-product power generation."

Here's why the Shelton plant meets its requirements best with a Ljungstrom Air Preheater:

1. Ljungstrom is the most efficient heat exchanger you can buy. The Ljungstrom rotor revolves continuously through the flue gas and incoming air, thus absorbing heat and releasing it *from the same surface*. Since the heat doesn't have to pass through anything, each inch of rotor surface is as efficient as one foot of a tubular recuperator.

2. Ljungstrom is the most reliable heat exchanger you can buy. All heat exchange elements pass through the entire air and gas streams. The temperature of the elements in the coolest region – where fresh air enters – is actually an average of the gas and air temperatures, so it's consistently higher than the coolest point in a recuperative heat exchanger. Result: no cold spots, less chance of moisture formation.

3. Ljungstrom is easiest to maintain. You can inspect it – and clean it–while it's running. Heat exchange elements are divided into modular baskets that can be replaced individually without disturbing the other elements. You can even reverse the elements if the surface has thinned on one edge, effectively doubling the life of the heat exchange surface.

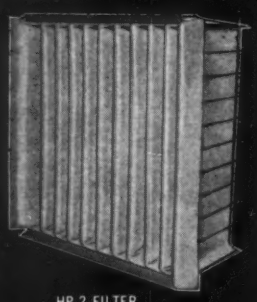
For more information on the Ljungstrom continuous regenerative principle, or on the Air Preheater that meets your requirements, phone MUrray Hill 2-8250 or write to The Air Preheater Corporation.

THE AIR PREHEATER CORPORATION

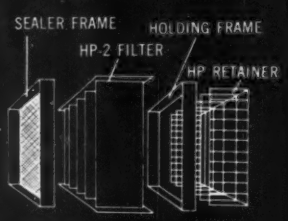
60 East 42nd Street, New York 17, N. Y.

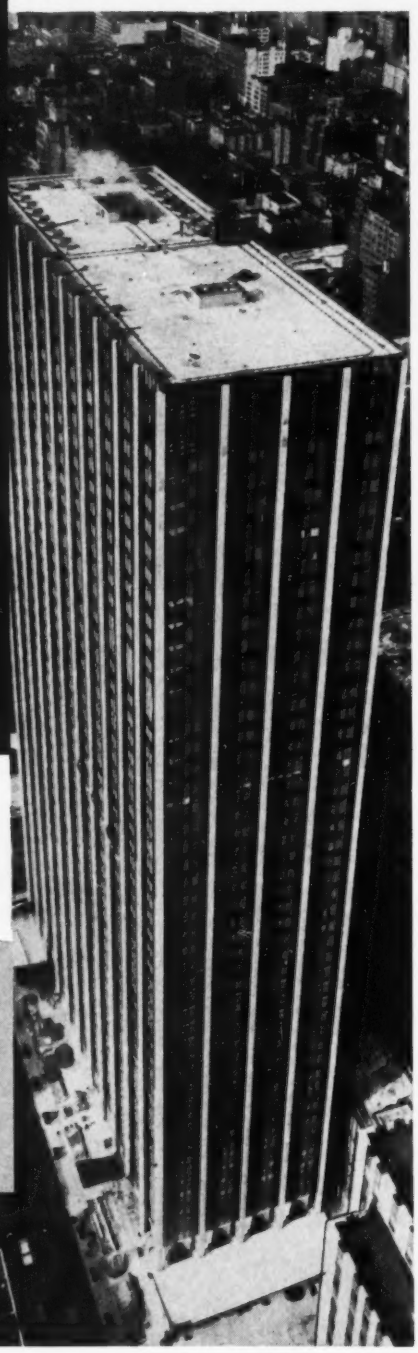
1,489,865 Cubic Feet of Air -Every Minute- Through Farr Filters For New Time & Life Building

A tremendous volume of air—1,489,865 cfm—for Rockefeller Center's new 48-story Time & Life Building, will be cleaned by Farr filters. Farr HP-2 disposable media filters and Farr Type 44 panel filters will meet the required efficiencies at the lowest cost per 1000 cfm—including installation and maintenance. ■ Farr HPs—a new series of folding, disposable media filters, are available in atmospheric efficiencies of 35%, 85%, and 95%. For full information, call your local Farr representative or write direct to Farr Co.



HP-2 FILTER





FARR COMPANY

Airport Station, Los Angeles 45, California

Time & Life Building, Rockefeller Center

Architects: Harrison & Abramovitz & Harris

Mechanical Engineer: Syska & Hennessy, Inc.

Mechanical Contractor: Almirall-Wolff & Munier—A Joint Venture

General Contractor: George A. Fuller Company and John Lowry, Inc.

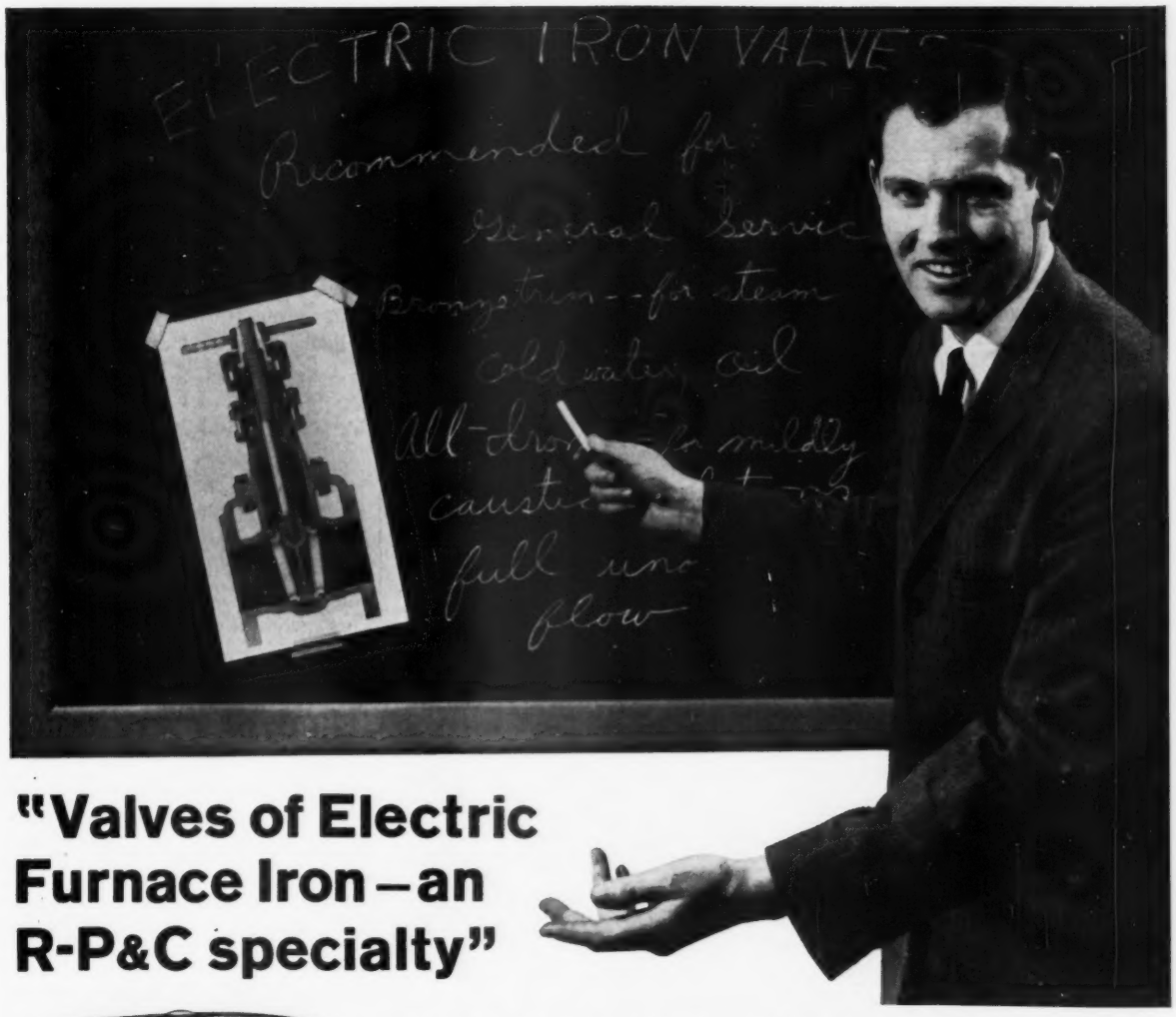
for daily bread with whomever he could.

"Man's inclination toward organization of his fellow man took hold of the engineering profession when greater knowledge and greater needs produced a flood of new engineers, many of whom found security in the regular pay checks of industry and government. The number and membership of professional societies and technical organizations multiplied, exercising vigilance over standards of practice and ethics; the man who preferred to seek his own clients was caught up in the flood. The organizations have become universally and indelibly imprinted on the minds of anyone interested in engineering in the form of initial letters.

"And yet, even in Canada, who has heard of FIDIC; and still there are some to whom ACEC means little or nothing. The waves of organization have submerged the identity of the consulting engineer to the extent that he has almost forgotten to organize himself. Almost . . . because FIDIC (International Federation of Consulting Engineers) was born before the first Professional Engineers Act was passed in Canada . . . almost, because ACEC (Association of Consulting Engineers of Canada) is 35 years old.

"Why these organizations are not as widely known as other professional engineering associations may be the fault of the organizations themselves. That, however, is not the issue. The real point is that both exist to serve the peculiar needs of the consulting engineer, and both are the concern of every consulting engineering practice in Canada.

"The world force of independent engineers is expanding at perhaps a greater rate than the total number of engineers – certainly this is the case in Canada. Canadian consultants should concern themselves actively and now with those organizations that exist to serve their



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Shown here is an R-P&C Gate Valve of the flanged end type. It is available in sizes from 2" to 24" in bronze trim or all-iron construction. The R-P&C Iron Valve line includes other popular types of Gate, Globe, Angle and Swing Check Valves—all made of Electric Furnace Iron.

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particular needs." – *Canadian Consulting Engineer*, June 1960.

Architect-Engineer Dispute

"A long-standing dispute between Ohio architects and engineers has erupted again. In Cincinnati last month the state's five-member Board of Examiners of Architects began hearings on charges that Architect Charles Burchard, 'by fraud and deceit,' permitted an engineering corporation to practice architecture illegally under the guise of a 'fictitious, nonexistent' complementary architectural partnership.

"On the second day of the hearing, before complete presentation of the state's case, however, the hearings were suspended indefinitely, when a serious illness in his family made it necessary for the special counsel pressing the charges to return to his home in Dayton. Pending the opportunity to present his formal defense, Burchard denied the charges and registered his dismay at the unforeseen delay in the proceedings, but expressed confidence in his ultimate vindication. Before the unanticipated postponement, Marcel Breuer was heard out of schedule as a character witness for Burchard, because he had already arrived in Cincinnati from New York for the purpose. After receiving MIT and Harvard degrees in 1938 and 1940, Burchard was an assistant professor of architecture at Harvard with Breuer from 1945 to 1953, worked in Breuer's office, and for a time had a private practice of his own in Cambridge.

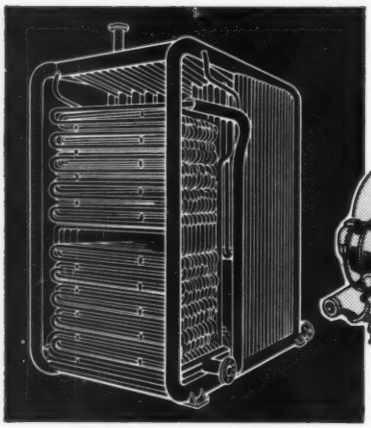
"The charges against Burchard arose from his dual relationship with A. M. Kinney, Inc., an engineering firm, and A. M. Kinney Associates, an architectural and engineering office, and an Ohio law prohibiting practice of a profession by a corporation. The state's complaint charges that A. M. Kinney Associates is a 'fictitious and nonexistent partnership,' and that Burchard's activities were primarily as an agent of the engineering firm, and thus permitted the corporation to practice architecture unlawfully.

"Said A. M. Kinney, Sr.: 'This is essentially a conflict between the architectural and engineering profession in Ohio. This results from a serious ambiguity in the statutes governing the areas in which these sister professions may practice. It is deplorable that the architects have seen fit to endeavor to settle this conflict by a deliberate and vicious attack upon a man of Charles Burchard's character and reputation.'" – *Architectural Forum*, July 1960.

Ethics and Payola?

"A university professor from a fine family is exposed to the public glare as a fraud and cheat; disc jockeys admit to payola, offering the defense that they were serving as 'consultants;' nonregistered persons pose as 'fiscal agents and engineers' to sell a Florida city on retaining them for a multimillion dollar project; spurious outfits with

New Ideas in Heat Transfer Bring Greater Operating Economy



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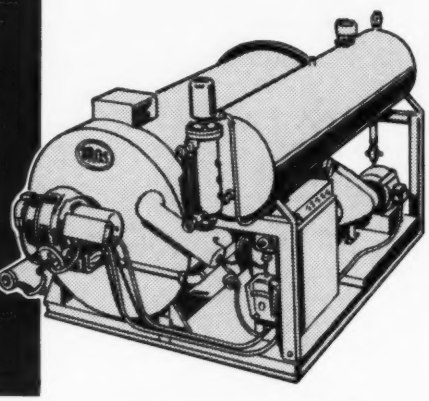

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The combination of forced and natural circulation, exclusive in the BROS Cornertube® high temperature water boiler, provides a highly controlled and flexible heat supply, without the necessity for metering orifices in the radiant section. Utilizing the high heat storage capacity of high temperature water provides 15 to 20 percent savings in operating costs as well as sizable savings in installation because smaller units, smaller piping and fewer fittings are required.

Capacity ranges from 4 million to 50 million BTU's per hour. Temperature ranges of 300° to 450° F are available with corresponding saturated pressures of from 70 to 425 psig. Higher and lower temperatures upon request. Low pressure steam can be generated by adding heat exchangers. Oil, gas, coal or combination firing units.

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Wherever hazardous area installations *or replacements* are made, you can depend upon this latest Appleton development to give you safe, foolproof protection. Write today for full details—bulletin No. CES 660.

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such awe inspiring titles as 'International Associated Engineers' obtain commissions, collect huge fees, and are declared bankrupt before the project is hardly begun; a nonregistered person operates under the fetching designation of 'Professional Engineers, Inc.' for over a year before, on threat of prosecution, he relinquishes the name.

"Are we now on the threshold of the most shameful and deceitful period in history? I do not think so. At the same time, the trickery, deception, fraud, and guile encountered might tempt one to believe that this is so.

"What can and should be done? Your ethics committees can do some good mainly by bringing questionable practices out in the open. The State Board of Engineers can improve conditions by publicity interspersed with an occasional case carried (possibly even unsuccessfully) to court. But the main good must be done by the rank and file member; by the ethical practitioner who talks, lives, and works for correct practice by bringing out in the open the shady and shoddy acts of both registered and nonregistered persons." — John W. Pennel, Chairman, Ethics Committee, Florida Engineer Society, in the *New Mexico Professional Engineer.*

Creative Design Approach

"The fresh, creative, and objective approach of the consultant, I believe, is his greatest strength. The approach to creative thinking is always interesting. In working with its problems and techniques, we have come to some firm conclusions on its nature.

"Creativeness is actually only putting known ideas together in new combinations. The more knowledge we have about things and relationships, the more new combinations we can make from them. That's why observant people with wide interests have so many good 'new' ideas. Put such analytical individuals together in a consultant's office and you have the potential answer to the really tough problems.

"In the field of an engineer's creative thinking it is necessary to solve problems completely. This is possible only through rigorous and disciplined thinking. There is little place for 'out of this world' thinking indulged in by advertising agencies in their brain storming approach . . .

"Design is the distinguishing characteristic of the engineer. The drawing board can be his most creative tool. There he can 'build' products, processes, machines, and structures to prove their reasonableness. Engineering graphics is part of the eloquent language of the profession.

"Regrettably, the drawing board in both college and industry is too often looked upon as a dead-end street rather than a channel of development. Much potential design ability has been killed by this unrealistic attitude in both our schools and industries." — E. C. Koerper, address to *ASEE.* ▲▲

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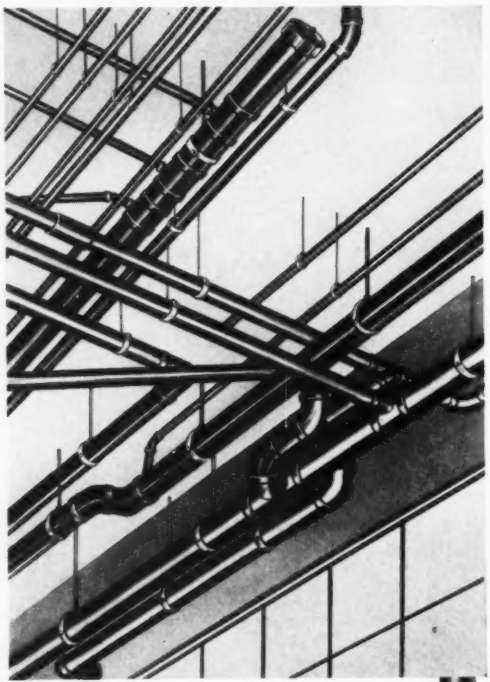
Costs Less, Weighs Less, Installs Faster than any other Acid-Proof Drainage System



Here's the proved, modern way to drain corrosive wastes—at less than half the cost of other systems. Vulcathene has everything you need—pipe, fittings, sinks, traps, in a wide range of sizes—competitively priced for *any* waste system. Save on economical installation and trouble-free, maintenance-free life:

FASTEST, EASIEST INSTALLATION! Lift 20′ sections with one hand; make leak-proof joints in *seconds* by the patented Polyfusion® method.

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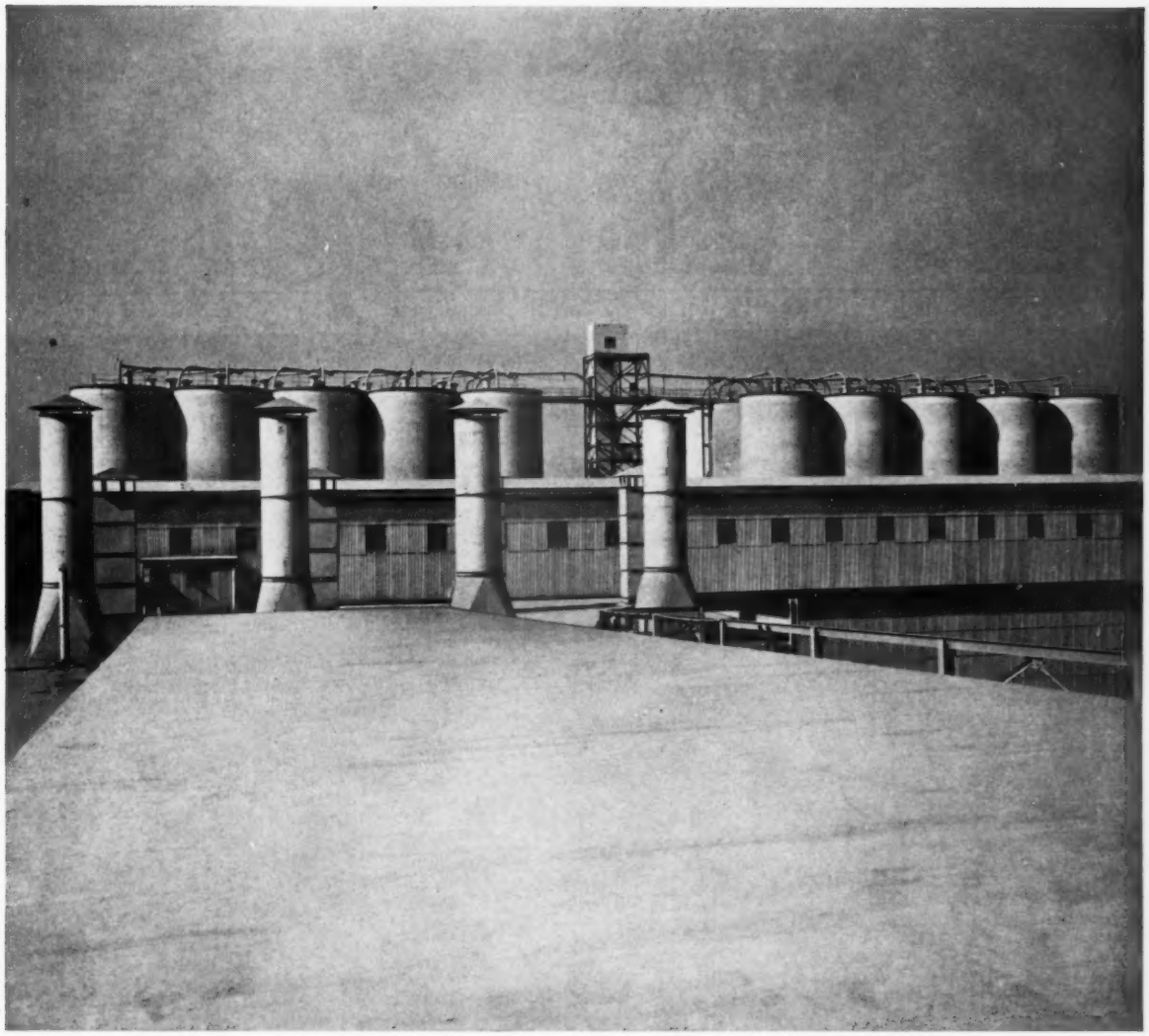

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Many plants, large and small, have made major savings by handling bulk products or raw materials with Fuller pneumatic conveying systems. For example, Fuller systems are delivering dry drilling mud to off-shore oil rigs; collecting fly-ash at large power plants; and handling cement in the several phases of manufacturing and distribution. Initial cost is rapidly recovered in increased operational efficiencies.

Fuller pneumatic "pipelines" install easily in a minimum of space, perform complex conveying operations automatically. If you have a materials handling problem, think pneumatics . . . *specify* Fuller. Write or phone today outlining your problem. Fuller will gladly furnish additional information with appropriate recommendations.

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Onan Electric Plants are when this independent

Big, beefy bearings for longer life. (Lower left) double-size Onan bearings vs. small bearings (right) used in many other makes. Larger bearing surface reduces wear, stretches time between overhauls. Onan builds up to performance—never down-to-a-price.

The engine that ran equivalent to 487,888 automobile miles. Here's endurance no auto could begin to match. Onan engine #1068 was operated for 12,197 hours. It was stop-started 100 times. At test's end #1068 and generator were delivering their stated output.

Performance Certified only

tester says O.K.

His job is to provide a double-check on Onan's own tests and testing methods

The man at the left is an expert from an independent testing laboratory. On the job, he believes nothing except what his trained eyes, ears and scientific testing instruments tell him.

He, and others like him, pay frequent surprise visits to Onan factories. He can pull any Onan plant off the test line. Put it through its paces. Recheck the checks Onan engineers and inspectors have already made. He has authority to pull a whole series of plants off the line if he finds one fault. He does all this even though every Onan plant is tested for hours by Onan personnel *before it is shipped.*

Onan takes these special precautions to make *doubly* sure your clients get all they pay for, and more, when they buy a Performance Certified Onan. For more details—and an analysis of your clients' stand-by power needs—see the Onan distributor nearest you. He's listed in the telephone classified section in all major cities. Or write direct.

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We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.
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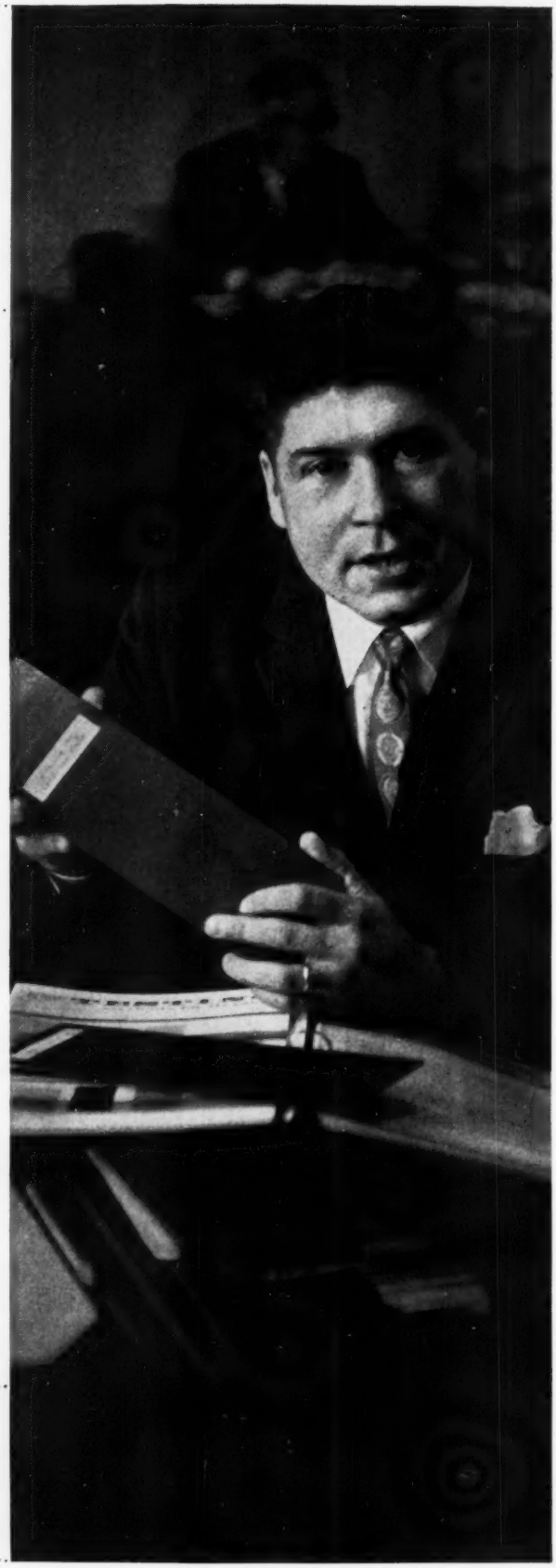

Jack Graham ought to know. As a member of Du Pont's special Technical Service Group, he's seen his recommendations pay off in terms of long-range cost reductions and job satisfaction for a variety of clients. Says Jack:

"Profit dollars are hard to come by. That's *one* reason Du Pont's systems of maintenance painting can be so important to *your* operation. We help you turn maintenance dollars into profit dollars for your clients. For instance, at a normal profit margin of 5%, $50,000 in savings—made possible by top-quality Du Pont finishes and technical assistance—is equivalent to the profit on an extra $1,000,000 of sales!

"Naturally, to help your clients realize maximum return on their maintenance dollar, quality paints are a *must*. Too many maintenance men have discovered, belatedly, that initial purchase price is an inaccurate determinant of value. Equally important are such factors as applied cost and job life. Which brings us to *another* reason why Du Pont paints are so often specified.

"You see, we spend enough time in the plant, examining equipment and conferring with maintenance personnel, to get a thorough understanding of your client's particular problem. Then we help you develop a step-by-step program for him, geared to achieve maximum protection against every corrosive condition possible—*at lowest cost per square foot per year.*"

If you have a maintenance problem you'd like to talk over with an expert, there's a man like Jack Graham—skilled, experienced, a "pro" in his field—ready to serve you. Just call your local Du Pont district sales office. Or write: E. I. du Pont de Nemours & Co. (Inc.), Finishes Division, Dept. CE-68, Wilmington 98, Delaware.

* * *

Trained as a chemical engineer, J. A. Graham joined Du Pont 15 years ago. Since then, he's devoted his time and talents to becoming a specialist in the field of industrial maintenance painting. In Detroit, Cleveland, Los Angeles and Philadelphia, he's helped solve problems of paint maintenance for the automotive, aircraft, steel, petroleum and marine industries. Now Eastern District Manager, Industrial Maintenance Sales, Jack is a member of the Corrosion Engineers Society.

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Our Authors

George R. Morgan is a vice president and head of the mechanical department of the J. E. Sirrine Company. He has been with the firm for 27 years. His article, page 94, on the consulting engineer in the role of purchasing agent is based not only on this long experience in private practice, but also on a considerable experience in contracting and sales engineering. Morgan has degrees in both mechanical and electrical engineering, one from Clemson College, and another from Cornell University. He is a member of the ASME, ASHRAE, and NSPE. In addition to registration in the State of South Carolina, Morgan is also registered in North Carolina, Georgia, Ohio, and Kentucky.

Dimitri A. Nesterenko and **Richard E. Witter** have coauthored an interesting article on the subject of dynamic structural design, page 96. Nesterenko is a graduate of the Technical University in Warsaw, and just prior to World War II had been appointed chief instructor of graduate structural work at that University. He came to the United States in 1948, at which time he joined the Stanley Engineering Company as a structural design specialist. He is now the firm's principal structural engineer. Witter is a graduate of the University of Minnesota in civil engineering, and a member of Tau Beta Pi and Chi Epsilon. He has specialized in structural design work, and is presently a specifications engineer with Stanley. Nesterenko and Witter combine a broad knowledge of structural practice, both American and European, and have done considerable research in the relatively unexplored (except for earthquakes) field of dynamic structural design.

Ben Persons is a Consulting Partner of Dames & Moore in Atlanta, Georgia. A graduate of Georgia Tech, he served during World War II as a captain in the combat engineers. As an earth sciences engineer, he has worked extensively on the Pacific Coast and in the Midwest. His present practice extends to those states which made up the Confederacy. He is a past president of the Consulting Engineers Association of Georgia and a past director of the Consulting Engineers Council. His article, page 122, paints an interesting portrait of the consulting engineer as an employer.

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Whether you're interested in service entrance equipment or a safety switch, you need look no farther than this newest Heinemann circuit breaker unit.

Far smaller than comparably-rated fused pull-outs, it carries a big 200-ampere load—consistently, without any allowances for ambient temperature. De-rating—or any form of temperature compensation—is simply unnecessary. The breaker is magnetically actuated; there's not a thermal element to be found. You can put this equipment next to heat lines, or inside a snow bank; it will always carry full-rated current, always trip as specified.

And it's easy to install. Wiring space is plentiful. So are knockouts (you can run-in conduit from any angle). Solderless screw-type connectors are another time-saver.

Rated at 120/240V AC, two- or three-wire service, this unit is available with indoor or raintight, tamperproof outdoor enclosures. Either way, it costs less than what you are used to paying for fused equipment with 200-ampere capacity after de-rating.

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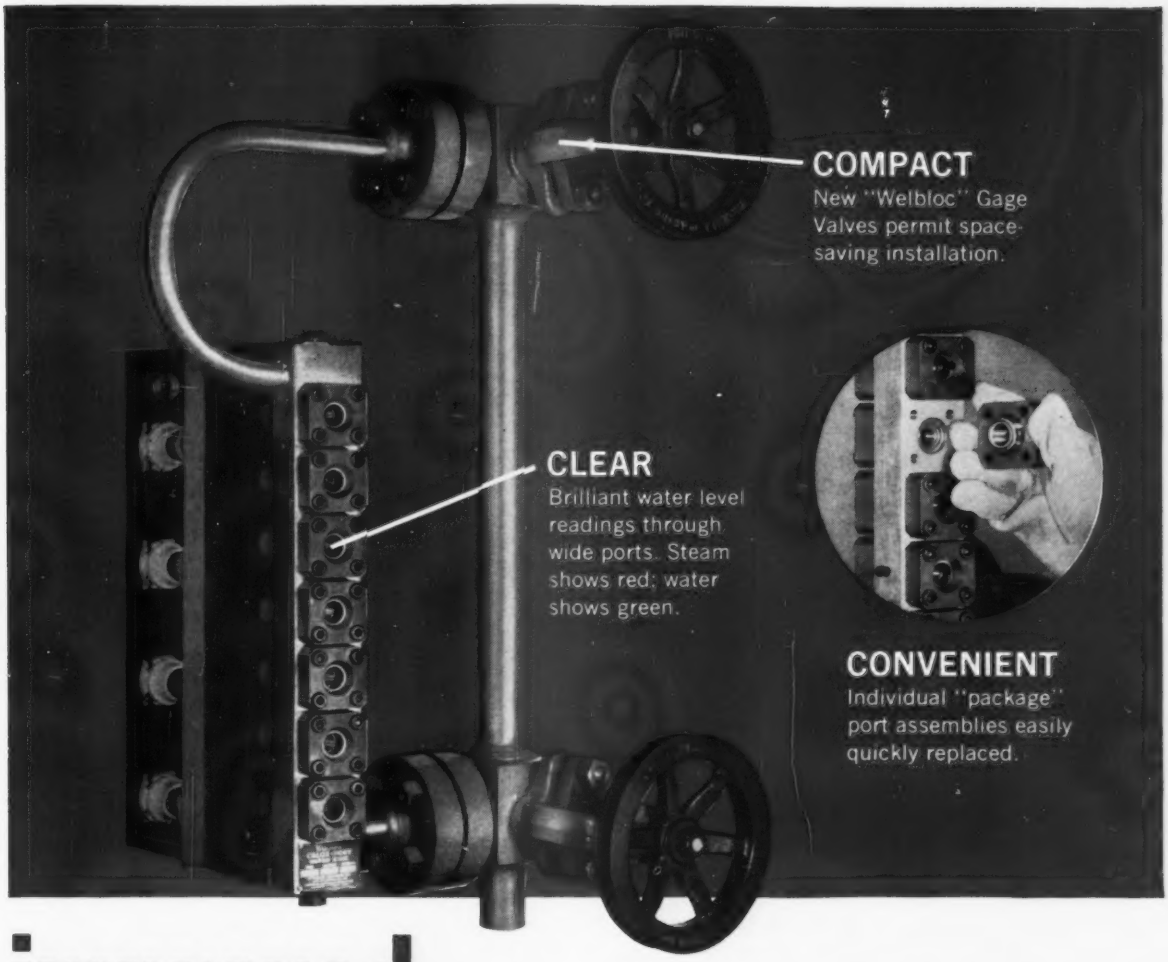
Paul N. Garay has written a number of papers on both conventional and nuclear aspects of the power field. His most recent on nuclear power appears on page 114. Garay is a mechanical engineer from Northwestern University, and began his civilian engineering career after a tour of duty as an engineer officer with the Navy. Before joining Kaiser Engineers, he worked on steam plant design and evaluation in connection with I.C.A. projects in the Far East.

John K. M. Pryke, of Slocum & Fuller, is probably best known as the first president of Consulting Engineers Council. Born in England, and educated at the University of London, it is not surprising that his New York engineering firm should become interested in Australian projects. His impressions of the consulting engineer profession "down under" appear on page 110. Pryke first came to the U.S. in 1936 on a fellowship. The war brought him back in 1944, and he has been here ever since.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New "Welbloc" Gage Valves permit space-saving installation.
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Brilliant water level readings through wide ports. Steam shows red; water shows green.
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Individual "package" port assemblies easily quickly replaced.

improved Yarway Color-Port Gages for medium pressure boiler service to 1050 psi*—with new "Welbloc" Gage Valves—offer you reduced maintenance, increased operational time, brilliant red and green level readings.

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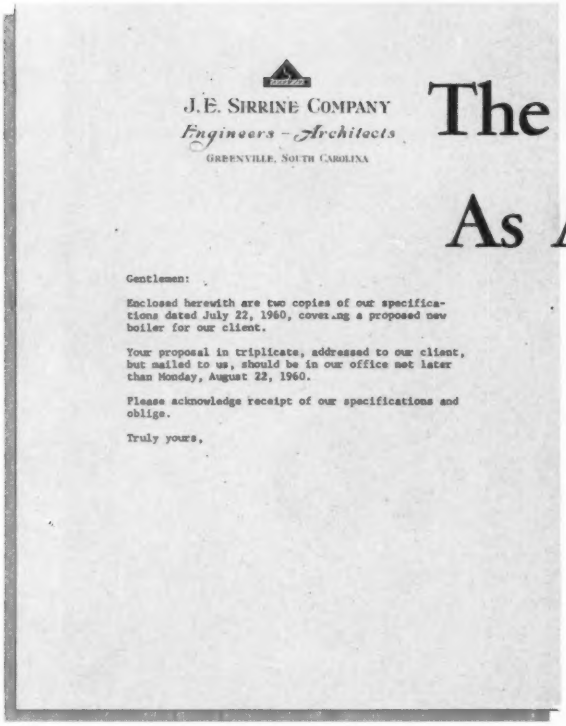


J. E. SIRRINE COMPANY
Engineers – Architects
GREENVILLE, SOUTH CAROLINA

Gentlemen:

Enclosed herewith are two copies of our specifications dated July 22, 1960, covering a proposed new boiler for our client.

Your proposal in triplicate, addressed to our client, but mailed to us, should be in our office not later than Monday, August 22, 1960.

Please acknowledge receipt of our specifications and oblige.

Truly yours,

The Consulting Engineer As A Purchasing Agent

GEORGE R. MORGAN
J. E. Sirrine Company

WITH THIS LETTER, the consulting engineer has assumed the role of purchasing agent for his client. He has been empowered to receive proposals, check them for correctness, and list them as to price and other details. He does not actually enter into a contract with the vendor, but he does select the specific items that he wants his clients to buy. The consulting engineer's position as agent is clearly defined by the request that vendors address all proposals to the client – even though they are mailed to the engineer.

CE exclusive

Within a few days after mailing the requests for proposals, the engineer receives acknowledgment from the vendors to whom the specifications were sent. Occasionally, one or more selected vendors are unable to furnish a proposal, and they are then removed from the list.

On or before the specified receiving date, the engineer begins to receive proposals from various vendors. He then begins to tabulate prices and other pertinent information. Each proposal is checked to see that it is in strict accordance with the specifications. If it is not, the vendor's representative is advised, and he is asked to make corrections. These changes must be confirmed by letter or telegram.

Some days after the receiving date for bids, the engineer will advise his client that he is ready to recommend which proposal to accept. If desired, a date can be set to permit the client himself to interview each vendor's representative to discuss the proposal in detail. Following this conference, the engineer and the client agree to a final selection, and the contract is awarded.

At the conference between the client, engineer, and vendor, the client may wish to request a reduced price or to enter into some other type of negotiation with the vendor. Under no circumstances should this involve the engineer. The engineer has already made his recommendation for purchase, and it was based on the price quoted by the vendor. The engineer has accepted that price as a proper one for the goods, and to involve himself later in any attempt to chisel on price would affect his reputation as an ethical practitioner to whom manufacturers' representatives can present honest proposals with confidence.

Advantages

So long, however, as the consulting engineer acts fairly toward all of the vendors while representing fully his client's interests the advantages resulting from this method of equipment purchasing are many . . . for all parties concerned.

¶ The list of bidders is by invitation, with only those having adequate representation and good reputation invited to bid. The resultant proposals

will include material and equipment of a quality satisfactory to the engineers.

¶ Specifications are less bulky because they need not describe in detail each item or accessory. Trade names and catalog numbers can be used, with provision for other manufacturer's equivalent items — provided they are approved by the engineer before proposals are received.

¶ The vendor gets closer to the owner since he is not bidding through a contractor. He therefore will take more interest in the proposal and better relations will result.

¶ The vendor generally will submit his very best price, and since the purchase is to be made directly from the manufacturer no additional cost is added by participation of a third party.

¶ In examining the proposal, the engineer can determine the annual operating cost of each of the various vendors' products and add this to the fixed charges based on the proposed price to determine the annual owning and operating cost. It is easily conceivable, and in fact, often happens, that the lowest priced proposal is not the one that results in the lowest annual owning and operating cost — which is, after all, what the owner wants.

¶ The vendor can deliver dimensioned shop drawings to the engineer much earlier than if the item of equipment were to be purchased by the general contractor after all plans and specifications had been prepared. The time consumed by the preparation of complete plans and by the general contractor in making his purchases can delay the receipt of shop drawings by several weeks or months.

¶ With early and direct receipt of shop drawings, the engineer can prepare his construction drawings based on a specific manufacturer's piece of equipment. All pertinent dimensions can be delivered to the general contractor at an earlier date than if receipt of shop drawings had to await purchase by the general contractor.

¶ With all details regarding each piece of equipment, together with its accurate dimensions, known at the time the construction drawings are first made, a minimum of extra engineering time and extra construction cost will result. The engineer can show on the construction drawings for the general contractor all items he needs for the complete construction to be planned and executed in an orderly, efficient manner.

¶ There will be a minimum of contractor requests for substitutions, since the purchase is directly between the owner and the vendor and not through the contractor. He has no pecuniary interest in making a change. Vendors also soon learn that the engineer normally does not entertain substitutions, for his specifications are explicit and firm. This eliminates the costly extra engineering time required when substitutes must be evaluated and re-evaluated by the engineer.

Disadvantages

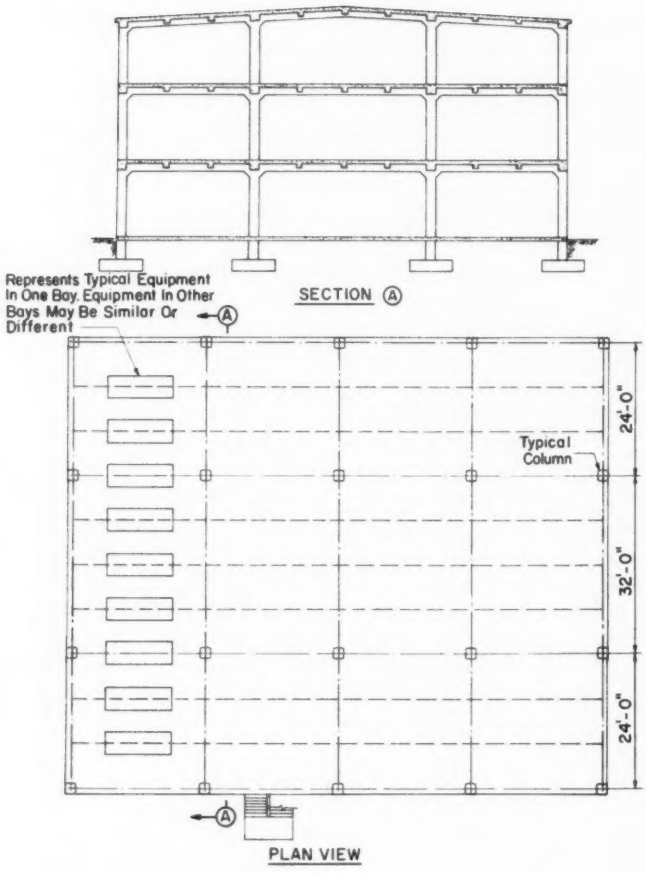
The main disadvantage to the engineer acting as a purchasing agent is the additional time he is required to give to this work. He must study all proposals and decide which is the proper one to recommend for acceptance. If, on the other hand, the item were purchased by the general contractor on the basis of open specifications, the engineer would be required to study only the one proposal submitted to him for approval. Should that proposal not be approved, the general contractor would have to submit another proposal. This might result in some confusion and delayed construction time, but the time required of the engineer still would not be as great as that required when he must evaluate all vendor proposals.

Another disadvantage is that the owner will have more contracts to handle when purchasing separate items directly from the vendors than if the entire project were handled under one contract with one general contractor. However, it seems to us that the advantages cited more than offset the additional auditing and bookkeeping costs involved for the client.

It should be re-emphasized that the engineer should never permit the client to force him into purely price negotiations with the vendor when there is no change in the specifications or scope of the work. The engineer must accept the vendor's first price at its face value and make a selection on that price as quoted with the proposal.

It is probably unethical, and certainly unwise, for the engineer to make a direct contract with the vendor, purchasing the equipment in his own name and then invoicing it to his client. This leaves too much room for criticism by the unsuccessful vendors that the successful vendor and the engineer had an under-the-table understanding.

The use of the consulting engineer as a purchasing agent by the client is best suited to large commercial or industrial projects where manufacturer's major products can be purchased direct by the owner from the vendor. They then can be installed either by the vendor's own construction organization or by a contractor. We have satisfactorily handled in this manner: boilers, strokers, feedwater heaters, pumps, refrigeration machines, air compressors, coal handling and storage equipment, ash handling and storage equipment, turbogenerators, and similar capital equipment. Specifications can be standardized so that the only part that needs to be written separately for a particular project is a technical description of the specific unit that is desired. ▲▲



Dynamic Analysis Avoids Vibration

Fig. 1 – Plan and section of a reinforced concrete industrial building of the type that should be subjected to a full dynamic design study.

DIMITRI A. NESTERENKO & RICHARD E. WITTER, Stanley Engineering Company

THE UNDESIRABLE effects of vibration are generally well known. Bridge structures have collapsed because of excessive stresses produced by vibration. Automobile engine vibration can set up repeated stresses that lead to fatigue failures of the members. The need for a dynamic investigation of such structures and equipment is apparent.

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Now, a growing recognition of the importance of dynamic design for industrial buildings is resulting from the increasing use of high speed machinery, delicate instruments, and elaborate control mechanisms. While the effect of vibration on human comfort and efficiency has not been thoroughly studied, it too is a matter of concern to the structural designer. It is true that isolated vibration problems in the plant usually can be remedied, but more generalized problems may be very difficult or even impossible to remedy. Thus, it is up to the structural engineer to provide his client with an industrial building that is structurally appropriate for both static and dynamic loads.

When to Use Dynamic Design

However, not all industrial buildings are suitable for dynamic analysis. Nor, for that matter, do all require a dynamic analysis. An industrial building can and should be investigated dynamically if:

¶ It is two or more stories high.

¶ It houses a uniform manufacturing, processing, or similar operation.

¶ The building floors support a large number of small machines. (If single pieces of heavy machinery are present, they usually are located at basement floor level and are separated from the rest of the building by means of isolation joints.)

¶ The building layout is quite uniform, particularly in the areas where actual processing operations take place. Uniform building layout would preferably include a uniform column spacing, uniform column

size, and the use of one type of floor construction for all building panels.

¶ The building is a monolithic reinforced concrete structure, or a steel structure with rigid beam to column connections.

A typical reinforced concrete industrial building of the type that should be investigated dynamically is shown in Fig. 1.

Conventional Coefficients Not Suitable

Fixed design coefficients often are used for the structural design of bridges, crane girders, and similar structures. The design load is determined by increasing the static load by a "dynamic coefficient." Unfortunately, there are a number of reasons why this approach cannot be used successfully for the dynamic design of industrial building floors supporting rotating machinery.

First of all, the magnitude of a "dynamic coefficient" depends on the ratio between the frequency of the exciting force and the natural frequency of the structural member. It would not, therefore, be a fixed value for all structural members. The fixed "dynamic coefficient" merely results in a structural member of greater mass — not necessarily desirable dynamically. Then, too, the use of such a coefficient in lieu of dynamic analysis would not reveal the possibility of resonance between a machine and its supporting structural members. Only through dynamic analysis can the actual vibration amplitudes be computed and compared with allowable values, and the effect of any unbalanced horizontal forces that may be acting taken into account.

Some Fundamental Concepts

The basic purpose of dynamic design is two-fold. Structural members must be selected so that a resonance condition is prevented, and amplitudes of vibration must be kept within allowable limits based on human body and mechanical equipment sensitivity.

On some projects, achieving a suitable result may be quite difficult. One example would be machinery of various types operating at various speeds, located side by side or in proximity. Under these conditions it may be possible to use different structural materials with different damping coefficients to avoid a resonance condition. In any event, the actual computed amplitudes always must be compared with the allowable.

In most industrial buildings where the floor system consists of monolithic concrete construction with floor slabs continuous over concrete beams, several resonance peaks may occur. It is not always necessary to compute all of these peaks. Quite often, only the highest and lowest need be computed.

To illustrate, consider the curve of the natural frequency peaks for a 4-span continuous beam as shown in Fig. 2. The vertical axis represents the ratio of the dynamic deflection (Y_{dyn}) to the static deflection at point of force application (Y_{st}). The horizontal axis represents the frequency of the exciting force (N_0). N_1, N_2, N_3, and N_4 are the natural frequencies of the beam.

For this condition, it is necessary to determine two peaks only, N_1 and N_4. Allowing for a 20 to 25 percent safety margin on each side of the curve because of the approximate nature of the computation, the resonance zone can be established. If the frequency of the exciting force, N_0, is outside the resonance zone, the amplitudes are usually small and acceptable. If the frequency of the exciting force falls within the resonance zone, several things may be done to achieve acceptable conditions. The dimensions or span of the structural member may be changed, or the location of the equipment may be changed.

Human Sensitivity

One of the basic building design criteria is the maintenance of amplitudes of vibration within an allowable limit based on the reaction of the human body. Vibrations caused by sound, falling objects, and operation noise are not directly related to the structural design, but may have significant effect on personnel. Some vibrations in the building structure induced by the moving machinery parts have little or no effect on the human body. On the other hand, others may decrease efficiency and quality of work, and even damage the nervous system.

The problem of human body reaction has not been thoroughly explored. Early research work was done by W. P. Digby and H. R. Sankey, more recent work by F. I. Meister and H. Reiher, and very recent work by R. J. Steffens and some USSR scientist. Table 1 is in general agreement with most of the research work done. It is based on

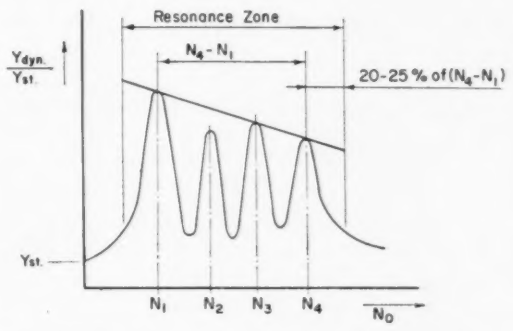

Fig. 2 — Curve of the natural frequency peaks in the resonance zone for a 4-span continuous beam.

TABLE 1 — SENSITIVITY OF HUMAN BODY

To induced vibrations less than 600/minute

Effect on human body	*Maximum acceleration of vibration (a = in./sec.²)*
No effect	0.35 - 0.45
Small effect	1.6 - 2.0
Large effect	14 - 16
Harmful effect	35 and higher

To induced vibrations greater than 600/minute

Effect on human body	*Maximum velocity of vibration (v = in./sec.)*
No effect	0.006 - 0.007
Small effect	0.025 - 0.03
Large effect	0.250 - 0.30
Harmful effect	0.6 and higher

harmonic motion with amplitudes less than 1 mm. It should be noted that for low frequencies, the acceleration of the vibrations is the governing factor. For medium and high frequencies, the velocity of the vibrations governs.

Mechanical Equipment Sensitivity

Mechanical equipment has varying degrees of sensitivity to structural vibrations. Certain precision-built automatic devices require almost complete freedom from all vibrations. Other equipment may be relatively insensitive to vibrations. As a guide to the problem of equipment sensitivity, equipment may be separated into three categories as shown in Table 2. A more exact breakdown may be necessary for a specific project.

Equipment RPM and Unbalanced Forces

The characteristics of the mechanical equipment housed in an industrial building have a direct influence on the dynamic structural design. The operating speed of the equipment and the magnitude of the unbalanced forces are of particular importance. A body is said to be in balance when its center of mass lies on its axis of rotation. If the two do not coincide, unbalance exists. The distance between the center of mass and the center line of the shaft is defined as eccentricity. Theoretically then, rotating machinery can be perfectly balanced. Actually, however, this seldom is achieved.

TABLE 2 — SENSITIVITY OF MECHANICAL EQUIPMENT

Degree of sensitivity	*Maximum velocity of vibration (v = in./sec.)*
High sensitivity	0.004
Average sensitivity	0.04
Low sensitivity	0.15

Some of the factors which help to create unbalanced forces in rotating equipment are non-symmetrical parts, poor distribution of mass, distortion in rotating parts at operating speed, and bent shafts. Thus centrifugal forces are produced when a shaft with a certain eccentricity rotates. These forces are denoted as unbalanced or exciting forces. Since the force turns with the shaft, its frequency is identical to the shaft rpm.

To illustrate the manner in which unbalanced forces are determined, consider a piece of rotating equipment weighing 100 pounds, operating at 600 rpm, and with an eccentricity of ⅛ inch. The centrifugal force can be computed from the formula:

$$F = KWRN^2$$

where K is a constant (17.75×10^{-7}); W the weight in ounces; R the eccentricity in inches; and N the shaft speed in rpm. In this example, F = 128 lbs.

To facilitate the dynamic design of the building structure, it is advisable to separate the mechanical equipment into four types (Table 3), based on the magnitude of these unbalanced forces.

With Type 1 machines, dynamic design is required only for very sensitive equipment. Type 1 machines usually have no adverse effect on personnel, and ordinarily no special consideration is needed in determining strength of structural members because of the small magnitude of the unbalanced forces. A dynamic design is required for all buildings supporting Type 2 machines. Special structural design may be avoided if the unbalanced forces are close to the lower limit of the force range. For Types 3 and 4 machinery, an extensive structural and dynamic design is required.

Dynamic Design of Structures

The actual dynamic analysis of the structure is lengthy. Quite often, an electronic computer may be adapted to facilitate the analysis of a specific problem. The actual scope of the dynamic analysis depends on the type of building selected, the type of machinery, and the location of the machinery on the floor. Building layout should be simple to facilitate a short and reliable dynamic design.

Vertical vibrations must be checked for all structural members, and frequently the horizontal vibrations are of importance. If so, the entire building frame must be analyzed as a unit subjected to the unbalanced horizontal forces. The horizontal

TABLE 3 — CLASSIFICATION OF MACHINES BY MAGNITUDE OF UNBALANCED FORCES

Type of Machine	Unbalanced Forces	Magnitude of Unbalanced Forces
1	Small	25 - 30
2	Average	30 - 250
3	Large	250 - 700
4	Very large	More than 700 lbs

vibrations may be subdivided into two groups: those in the direction of the unbalanced forces of the machinery (usually parallel to one building side); and torsional vibrations caused by the eccentricity of forces with respect to the center of gravity of all columns.

Physical dimensions of the structural members must be selected such that vibrations will be within the allowable limits based on human body and equipment sensitivity. The design also must, of course, prevent a resonance condition.

When proper dimensions of the structural members have been found, the final structural and dynamic design may be completed considering both static and dynamic loads. For a horizontal beam, for example, the sum of the actual static and dynamic moments and shears must be less than the allowable moments and shears.

Damping

In equipment foundation design, damping is relatively unimportant and often is neglected. However, damping is an important factor in the dynamic design of building structures. A reinforced concrete building frame, for instance, has unquestionable damping ability. According to Sorokin:

$$\gamma = \psi \div 2\pi = \delta \div \pi$$

where γ is the coefficient of nonelastic resistance of material, ψ the coefficient of absorption, and δ the logarithmic decrement of damping.

To illustrate the effect of damping, consider the following formula for amplitude of vibrations for a system with 1 degree of freedom.

$$X = \Delta_{st} \div \sqrt{[1 - (N_0^2 \div N_1^2)] + \gamma^2}$$

where X is the amplitude of forced vibrations, Δ_{st} the deflection due to static load, N_0 the forced frequency of the machine, N_1 the natural frequency of the system, and γ the coefficient of nonelastic resistance of material.

Considering a pure elastic body with no damping ability ($\gamma = 0$), and where $N_0^2 \div N_1^2 = 1$ (resonance condition), amplitude, X, is infinite.

Considering a reinforced concrete frame with damping ability (assume $\gamma = 0.1$) and $N_0^2 \div N_1^2 = 1$ (resonance condition), the amplitude of vibration, $X = 10\ \Delta_{st}$, or the amplitude has been reduced from an infinite value to only 10 times the static deflection. In certain isolated instances, the damping ability of the concrete frame would allow the existence of a semiresonance condition between the structure and machine to exist, providing the amplitudes of the vibrations were still below allowable limits.

On certain projects, where it is impossible to achieve acceptable dynamic conditions otherwise, special mountings can be used for the equipment (Fig. 3). Use of springs is not uncommon in large equipment foundations; for instance, intermediate speed diesel engines (600-1000 rpm).

Providing spring supports for a large number of small machines would, of course, be impractical because of excessive cost as well as installation and maintenance difficulties. However, occasionally a spring support may be very desirable. Springs are good transmitters of sound and will therefore require special soundproofing treatment.

The use of rubber supports is of somewhat less importance, but still practical for special applications. Rubber supports will not substantially alter the dynamic characteristic of the floor system, but may decrease the amplitudes of the vibrations. Unfortunately, these supports gradually lose their elastic properties. ▲▲

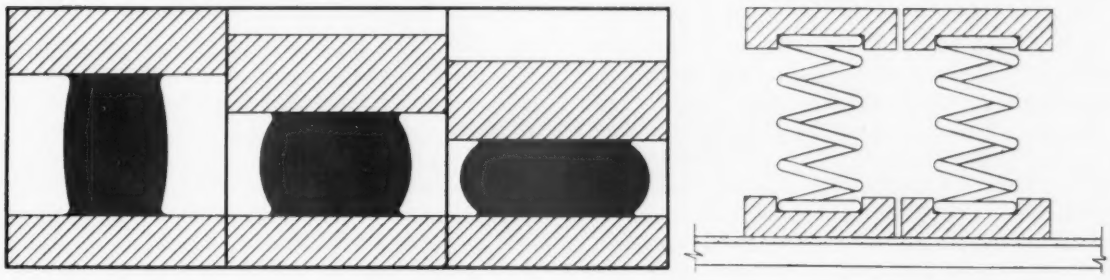

Fig. 3 – Special equipment mountings, including rubber or spring supports, may be practical for some applications.

What Did Hoover Really Report?

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WHENEVER TWO OR MORE engineers are gathered together, it is not long before the conversation turns to public works and who should handle the engineering – consulting engineers or government employee engineers. Professional ethics, not withstanding, it is frequently assumed that the government's engineering should be done by whoever can do it at the least cost. This presupposes that government engineers and engineers in private practice are of equal proficiency and their work of comparable quality–an unwarranted supposition.

It is not difficult to get figures on fees charged by consulting engineers for their services on government projects. A number of organizations have made studies of this, the most recent having been conducted by the National Society of Professional Engineers (page 84, April). The conclusion reached, as might have been foreseen, was that consulting engineers are not overcharging the government for either design or supervision of construction. The survey also proved that some (and probably a great many) consulting engineers are charging the government considerably less than NSPE or any other engineering organization recommends as a proper minimum fee. In fact, this survey shows that the government is getting engineering services at surprisingly low prices when it engages consulting engineers. Ethical consulting engineers who try to charge according to recommended fee schedules might question the quality of some cut-rate work.

The real problem is getting comparable data on cost of engineering work done by employee engineers of the government – Federal, state, or local. Figures are easy to come by. Every government department engaged in engineering work has cost figures, but where the accounting methods permit cost comparisons with the fees of consulting engineers, it turns out that the nature and extent of the work is different; or where the work is comparable, the accounting methods are not. Investigators, amateur and professional, so far have been frustrated, and when the frustration becomes unbearable, they resort to quoting the "Hoover Report."

Engineers may be careful of what they say in their own original writing, but they appear to trust,

in all innocence, any statement they see in print. At least, that is what one would judge on the basis of the many references to the cost of government engineering "as published in the Hoover Report."

No one, it appears, has bothered to read the Hoover Report to see what it has to say about engineering costs on public works. Actually, the Hoover Commission (the Commission on Organization of the Executive Branch of the Government, set up in accordance with Public Law 108) had absolutely nothing to say about the costs of engineering, government or otherwise, in its *Reports to the Congress*. Engineers in private practice, individually and collectively, should get that straight.

For the record, there were two Hoover Commissions. The first was authorized under Public Law 162, of the 80th Congress, approved July 7, 1947. Its final reports on a number of aspects of organization of the executive branch of the government were presented to Congress during 1949. In the work of this first Hoover Commission, the areas of investigation and recommendation were selected, and then the real research was conducted by special groups of experts and authorities known as task forces. Each task force had its own area of study, and as the assigned work was completed, each prepared its task force report to the Hoover Commission. The Commission then took what it liked and rejected what it did not like and prepared its own *Reports to the Congress*. These task forces for the first Hoover Commission covered a range of topics from Agriculture and Business Enterprises through Veterans' Affairs, but the only one of direct interest to consultants was prepared by Robert Moses, as a Chief Consultant of the Task Force on Public Works.

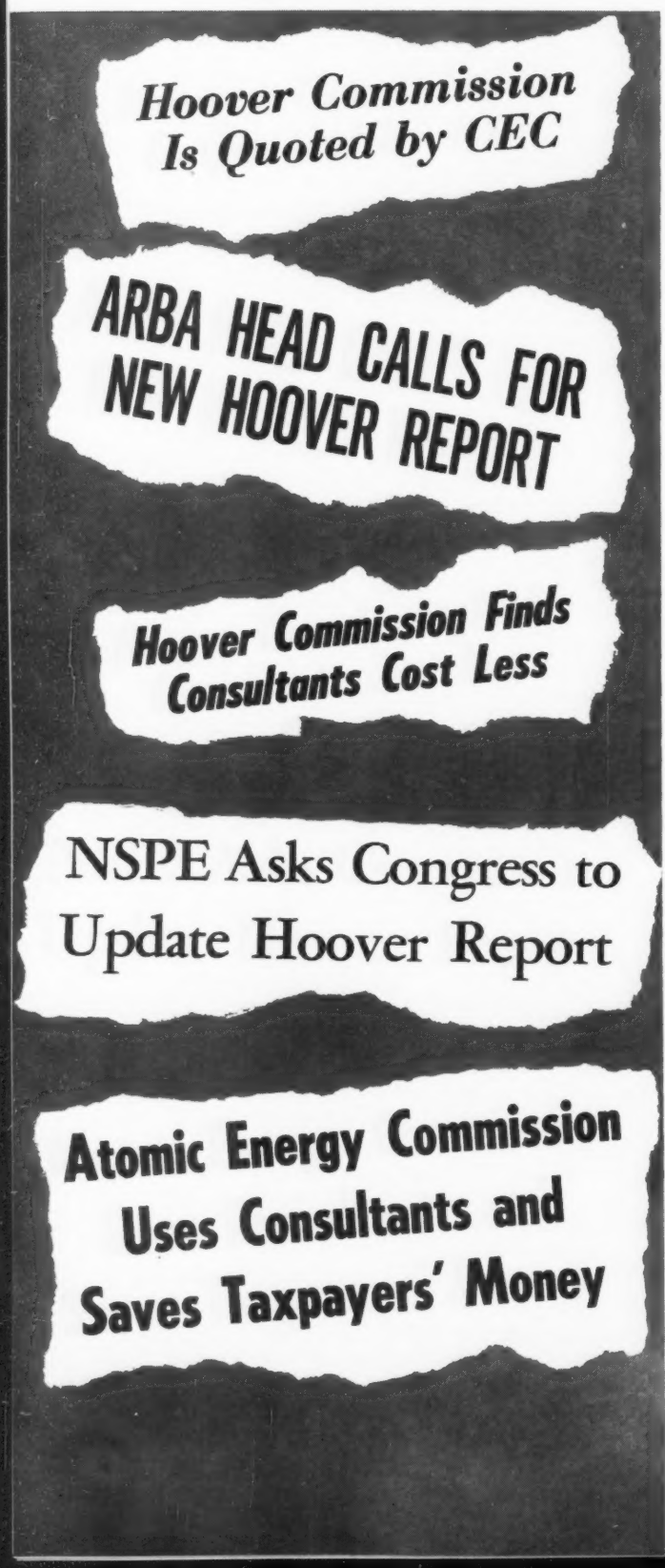
Moses' *Task Force Report on Public Works*• is a gem. It should be read and reread by every engineer in government or in private practice. Moses and his group recommended that there be established a Department of Public Works with a Secretary of Public Works in the Cabinet. This department would take over all the engineering, construction, and maintenance of all public works from roads, airports, and parks to public buildings, hospitals, dams, power plants, docks, shipyards, and military establishments. It would replace all the engineering and construction divisions of all the other government departments including the military. Army engineers would get their project experience while on special assignment to an Under Secretary of Public Works.

•*Task Force Report on Public Works [Appendix Q]*, prepared for the Commission on Organization of the Executive Branch of the Government, Jan. 1949, U. S. Government Printing Office, Washington 25, D. C., 25 cents.

Comments Champion Private Enterprise

Then, Moses warned, "Where engineering activities are concerned, and no matter how the new Department of Works is organized, the traditional tendency to build up a large permanent civil service force, in the absence of a foreseeable and continuing need, should be opposed and counteracted. Civil service forces in many Government engineering bureaus invite justified criticism of unnecessary multiplication of permanent personnel and overhead expense for specific projects which would be better and more cheaply designed and supervised on a consulting fee basis. We need competent top engineers in civil service, but it is only human nature for the rank and file who are paid out of limited project funds to string out the work and make it last as long as possible. (Note that here Moses anticipates Parkinson's First Law). Adoption of a policy to retain qualified engineers engaged in private practice for specific purposes on a fee basis would expedite work, reduce overhead costs, afford an opportunity to secure specialized personnel for such specialized work, and would encourage professional pride without weakening the 'esprit de corps' of the permanent civil-service personnel."

Moses continued on that theme for page after page of his task force report, always recommending a small, competent, well paid civil service that made


Hoover Commission Is Quoted by CEC
ARBA HEAD CALLS FOR NEW HOOVER REPORT
Hoover Commission Finds Consultants Cost Less
NSPE Asks Congress to Update Hoover Report
Atomic Energy Commission Uses Consultants and Saves Taxpayers' Money

full use of consulting engineers. A better statement could not be had. Moses expressed the beliefs of engineers in private practice about as well as they could be expressed. And this opinion was not hidden in some speech made before a small society nor was it published in the pages of a soon-discarded periodical. It was put on the record in the form of a printed and bound report addressed to Hon. Herbert Hoover, Chairman, Commission on Organization of the Executive Branch of the Government, signed byRobert Moses, Chief Consultant.

Mr. Hoover attached his own letter of transmittal and sent the report to the President of the Senate and the Speaker of the House of Representatives. Hoover's letter of transmittal, however, calls attention to the fact this is a report of a task force, and "The study of each task force naturally is made from its own particular angle. The Commission, in working out a pattern for the Executive Branch as a whole, *has not accepted all the recommendations of the task forces.*"

Mr. Hoover and his Commission, in other words, did not always agree with the findings of their task forces, and while they had no objection to Congress seeing what Mr. Moses had to say, the real recommendations, Mr. Hoover makes clear, are to be found in the *Reports to the Congress.*

Unfortunately, Mr. Hoover failed to carry any of Moses' task force recommendations over into the Commission's own reports. The omission of Moses' ideas stands out like a missing chapter in a censored book. The fact that one-time engineer Hoover could fail to back the basic ideas of engineer Moses is hard to explain, but all of Moses' strong arguments in favor of private practice got nowhere.

When Senator McClellan reported to the Senate on the status of the Hoover Commission reports, in 1952, he said that 46 public laws had by that time been passed by Congress in implementation of the Hoover Commission reports. None of these involved any of the recommendations of Moses' task force. There was one bill proposed to the Senate that would have transferred the civil functions of the Corps of Engineers from the Department of the Army to the Interior. This fragment from Moses failed to get anywhere. However, Congress did set up a weak form of General Service Administration.

So far as the first Hoover Commission was concerned, Robert Moses' task force fought for the consulting engineer, but it not only failed to get its

ideas through Congress, it never even got them past the Commission itself.

The Second Hoover Commission

If the first Hoover Commission failed to do much to straighten out the confusion in design, construction, and operation of real property owned by the Federal government, it was a little more successful in securing improvements in some other areas of the executive branch of the government. Therefore, since hope springs eternal, a second Hoover Commission was established under Public Law 108 of the 83rd Congress. It took effect on July 10, 1953, when the bill was signed into law by President Eisenhower.

This Hoover Commission, again officially called the Commission on Organization of the Executive Branch of the Government, was made up of Herbert Hoover as chairman and the following members: Herbert Brownell, Jr., Arthur S. Flemming, James A. Farley, Senator Homer Ferguson (who resigned in 1955 and was replaced by Senator Styles Bridges), Senator John L. McClellan, Solomon C. Hollister, Robert G. Story, Rep. Clarence J. Brown, Rep. Chet Holifield, Joseph P. Kennedy, and Sidney A. Mitchell. The Executive Director of the Commission was John B. Hollister; Deputy Executive Director was W. Hallam Tuck; Executive Secretary was Francis P. Brassor; and Harold W. Metz was Director of Research.

John B. Hollister, the Executive Director of the Commission and a Cincinnati attorney, should not be confused (but often is) with Solomon C. Hollister, a member of the Commission and Dean of Engineering at Cornell.

This second Hoover Commission was set up much like the first, and it operated in about the same way. The major difference was that in establishing this second Commission, Congress not only authorized the Commission to look into the operation of government but also into its functions, programs, and policies. Mr. Hoover interpreted this to mean that he was given even broader authority for investigations and recommendations than he had been in his first assignment.

Again, the Commission decided what areas it would deal with, and it set up its task forces. Many of these areas were similar to those of the first Commission, while others were logical extensions of the earlier studies. But, it is interesting to note, the topic of Public Works was not put onto the new list despite the fact that neither the first Commission nor the Congress had taken any satisfactory or conclusive action. Just why public works was dropped on the second go-round is hard to say, but it looks as though the subject was avoided because there was no hope of getting any really important reforms through Congress or even through the politically heavy Commission.

The closest the Commission came to permitting a public works study was its selection of Real Property Management as one area to be investigated. The Task Force on Real Property Management, however, was headed by John R. Lotz, former chairman of the board of Stone & Webster. On his committee we find William V. Burnell, a former vice president of Stone & Webster, as well as several experienced lawyers, a banker, and three business executives. The Staff Director was Ben P. Gale, a prominent real estate man, and the Chief Consultant was another former vice president of Stone & Webster, Lockwood J. Towne.

The task assigned would seem fairly clear from the title, "Real Property Management," but with the Chairman, one member, and the Chief Consultant all ex-management men of Stone & Webster, it was quite natural that not only property management but construction was found worthy of study. In fact, an inspection of the records of this task force indicates that one of the real interests of the group was studying costs of design and construction of public works, both military and civil. They picked up Moses' eloquent plea that design and construction of public works should be done by private engineers and contractors – and tried hard to find data to support it.

In April 1955, just over five years ago, this task force submitted its report to the Commission. It discussed the government's real property from three points of view; acquisition, construction, and, of course, management. As might have been anticipated, this was not what the Commission really wanted. The Commission was interested only in real property *management*, just as the name of the study stated. The task force report contained long chapters not only on management of real property but on "Federal Acquisition of Real Property," and "Design and Construction." Both of these chapters were dropped when the actual Hoover Commission report on real property management was submitted

to Congress by Mr. Hoover on June 6, 1955. Again there was the warning in the letter of transmittal, "The recommendations of the Commission do not necessarily coincide with all of those of the task force . . ."

Perhaps the Commission felt that this task force had overstepped its specified boundaries. At any rate, the Commission refused to adopt as its own the recommendations having to do with either acquisition of real property or the areas of design and construction.

This means that none of the references to the "Hoover Commission Report" now being tossed about by so many engineers and engineering organizations are actually from the Hoover Commission at all. Instead, they are from the *Task Force Report on Real Property Management* – and they were totally disregarded by the Hoover Commission in making its own *Report to the Congress.*

Why the Discrepancy?

Why did the Hoover Commission refuse, for the second time, to accept the recommendations of a task force that stated government agencies should make the greatest possible use of consulting engineers and architects in the design of government projects? Surely Mr. Hoover favors private enterprise over government bureaucracy?

Different answers come from different directions. Harold W. Metz, who was Director of Research for the Hoover Commission, says it was simply a matter of the task force on real property management going beyond its assigned task. The Commission wanted it to stick to management of real property and avoid the topics of acquisition or engineering and construction. Therefore, it simply threw out all task force recommendations that went beyond the specific topic assigned. He pointed out that engineering and construction of public works had been thoroughly studied by Moses' task force. Since the first Commission and Congress had not agreed with the recommendations, Mr. Hoover had no intention of going over this same fruitless field again.

John B. Hollister, Executive Director of the Commission, now back at his law practice in Cincinnati, agrees with this but puts the emphasis on the Commission's knowledge of what would and what would not go through Congress. Moses' recommendation of a Cabinet level Department of Public Works had been ignored, and the only result in this whole area of study was the establishment of the General Service Administration. But it was so limited in the original act that "Effective execution by GSA of its responsibility under Public Law 152 (81st Congress) [was] almost impossible . . ."

Since this was the best that the 81st Congress could do, the new Hoover Commission felt that it would be better to consolidate this gain, strengthen the General Service Administration, and straighten out the management methods applied to government property rather than to attempt to go back and start again on the problems of design and construction. This Hoover Commission knew, according to Hollister, that there would be too much opposition – from, for example, the Department of Defense – to any legislation that would reduce or limit the design work of either the Corps of Engineers or the Bureau of Yards and Docks. This being true, the Commission reasoned, it was better to try for that which actually could be done rather than go after the obviously impossible.

A former member of the task force also pointed out that, even at the time, he had been conscious of the group being led somewhat off its assigned topic by the heavy engineer-constructor background of so many of the top persons affiliated with the task force. A Congressional Committee looking at the composition of the task force and its consulting staff could conclude that this report was not unprejudiced by self-interest.

Recommendation No. 19

It is likely that all of these reasons had something to do with the failure – the second failure – of the Hoover Commission to carry over any of its task force's recommendations on design and construction into its *Report to the Congress.* However, the task force on real property management, whether it was overstepping its proper bounds or not, did publish in its own report a chapter on "Design and Construction." It is there that one finds the familiar Recommendation No. 19:

"That the Federal design and construction organizations (a) retain in their own organizations only the personnel required for preliminary study, preplanning and budgeting, and essential supervisory management and control, and (b) contract to private architect-engineering and construction firms design and supervision of construction to the maximum extent consistent with national security."

> "Recommendation No. 19 of the task force report advocates that all Federal agencies engaged in architectural functions relating to constructions *(a)* retain in their own organization only the personnel required for preliminary study, preplanning and budgeting, and essential supervisory management control, and *(b)* contract to private engineering and construction firms all design and supervision of construction on Federal projects to the maximum extent consistent with national security. The task force estimates that, based on the present volume of Federal construction, the wholehearted implementation of this recommendation would result in an annual savings to the Government in the cost of design and supervision of construction alone of more than $100,000,000."
>
> *From a letter by John R. Lotz, task force chairman, to John B. Hollister, executive director of the Commission*

It is to be noted that this excellent statement loses some of its impact when it is known to be the recommendation of a committee headed by an ex-chairman of the Board of Stone & Webster (and supported by two ex-vice presidents of the same firm) rather than the recommendation of the Hoover Commission itself. Failure to note this difference has been an error of many engineers and engineering organizations.

But, if the data presented in the report is accurate and supportable, it is not made less so because some of the members of the task force could be accused of self-interest. Truth is not distorted by the nature of its discoverer.

The task force, in its study of design and construction of government projects states that it found that "The cost to the Government of its design and construction activities is abnormally high and out of line with the cost of similar work in private industry." It goes on to recommend that all the government agencies do as the Atomic Energy Commission does and make the greatest possible use of private engineer-architect firms and thereby cut their design costs down to the level of the exemplary AEC.

This sounds good, and every consulting engineer fervently wishes that it could be firmly established and backed up with indisputable evidence. Unfortunately, it cannot, and resolutions to "update the findings of the task force on real property management" are asking for the updating of a most inconclusive study of government engineering costs.

Differences in Accounting Noted

This is not to say that the members of the task force's staff did not try. They tried desperately. The data of the staff fill drawer after drawer of files. In fact, they fill a whole roll of microfilm from which much of the material for this article was gleaned. They are worthy of detailed study by engineering societies trying to get data on costs of government engineering. They do include some figures that would go far to substantiate the contention of consulting engineers that government engineering by government employee engineers is more costly than it should be. But mostly they show only that different departments of the government handle their accounting in such different ways that comparisons from agency to agency are meaningless.

To try to extend these data generally to a comparison with outside private engineering firm fees is impossible – even if it were desirable to compare engineering services on a cost basis. It is no wonder that the Hoover Commission in its actual *Report to the Congress* laid so much emphasis on the need for uniform and full accounting throughout all government agencies. Uniform accounting is required before comparisons can be made.

The task force, after remarking on the high cost of government design and construction work, continues, in the same paragraph, to complain of "the many different standards and management practices; and . . . the absence of operating data which would provide a means of comparing the effectiveness of numerous Federal design and engineering organizations." A study of the detailed data in the files of the task force further confirms the lack of uniformity from agency to agency and the hopelessness of accurate cost comparisons. One wonders how the task force was able to reach such firm

conclusions concerning comparative costs in its report in the "absence of operating data that would provide a means of comparing . . ."

The accompanying table, a reproduction of "Table IV-2 — Comparative cost of agency design and construction services" as published in the task force report, is the best that the staff could come up with in the way of comparisons between government organizations' engineering costs. The pertinent column of data is the one headed "Service cost (percent of construction cost)," which, the text states, "includes administrative and design costs, and supervision of construction to and including the level of the headquarters offices."

Since these figures have been so widely quoted, the data on which they are based deserves further study. The collection of the figures from the various agencies of the government fell upon T. R. Thornberg, of the task force staff, with considerable help from Ben P. Gale, Staff Director. They studied each of the government organizations listed in the table, in turn.

The Atomic Energy Commission

The first item in Table IV-2 shows the Atomic Energy Commission as engaged in 119 projects with an estimated cost of over $4 billion. The table also shows AEC's engineering and construction staff employees at 448 and the service cost as 5.23% of construction. This percentage figure includes, according to the task force records, 4.76% for preliminary engineering, plans and specifications, and supervision of construction. In addition, AEC reported an overhead cost of 0.35% of construction cost, giving a total of 5.11%. This was brought up to the published 5.23% by the addition of a small amount for legal, procurement, and security services on the construction programs.

The 0.35% for overhead cost is extremely small, but it is believable because AEC apparently turned over its projects entirely to outside engineering and architect-engineer firms and had only 43 persons in Washington and 405 persons in the field charged against this overhead.

A preliminary unpublished data sheet in the task force files states, "The fees paid for engineering vary with the size and amount of engineering required for a given project. Variation runs from 0.422% for a project costing $121,185,000 to 3.29% for a project costing $95,000. Fees for construction supervision vary from 0.85% to 3.4%. One particular project costing $241,761,519 with an engineering and construction fee of 0.152% appeared in the record." It is obvious that the lower of these fees

Table IV-2.—Comparative cost of agency design and construction services

[Dollars in millions]

Organization and source of data	Estimated cost of active projects[1]	Total present engineering and construction staff employees	Service cost (percent of construction cost)
Atomic Energy Commission (119 current projects)	$4,292	448	5.23
General Services Administration (22 projects)	94	[3] 533	6.71
Navy—Bureau of Yards and Docks, fiscal year 1954	352	2,627	8.17
Army—Corps of Engineers:			
Military work (including work for Air Force)	1,145	[3] 8,467	10.75
Civil work, fiscal year 1954	423	[3] 9,130	12.15
Air Force—independent of Engineer Corps (under construction September 1954)	762	(4)	(4)
Tennessee Valley Authority (4 projects)	245	[5] 1,774	16.7
Veterans Administration:			
Fiscal year 1947-54 inclusive	310	.....	10.09
Fiscal year 1954 (including above)	17	499	17.8
Bureau of Reclamation, Department of the Interior (estimates of 15 projects)	670	[5] 6,300	17.0

1 For projects included in this study, except where noted as fiscal year expenditures.
2 On new construction and maintenance.
3 This figure excludes all personnel in the Office of Comptroller, personnel office, service of supply, real estate, and legal.
4 Not available.
5 This figure includes personnel in the offices listed in note 3 who service design and construction.

must represent payment for something quite different from what consulting engineers normally would call engineering design and construction supervision.

The archives also include a list of construction contracts awarded by the Atomic Energy Commission in the early 1950s. Of particular interest is an Oak Ridge contract for engineering on a job running from December 1948 through February 1951, with a construction cost of $121 million for which the fee was $511,272, or 0.422%. This is stated to include preliminary surveys, preliminary studies, detailed designs, and supervision of construction. This is followed by another project with a 0.63% fee and then by one with a 0.435% fee. The first of these was for utilities and utility buildings at Oak Ridge, while the second is in connection with primary power facilities at Oak Ridge!

No one can seriously believe that these fees represent profitable undertakings by the engineers if they are really fees for the type of work that they purport to be.

The Savannah River Project of the Atomic Energy Commission provides an interesting and recent case history – an "updating," one might say. This was contracted to duPont for design, development, construction, and operation. The construction was negotiated on the basis of reimbursement for all costs incurred under the contract, plus a fixed fee of $1 for the duration of the contract. The completion date of this contract was June 30, 1960, just a few weeks ago. Reports indicate that approximately $1.4 billion in construction costs on this job had been expended as of June 30, 1959, and approximately $85 million had gone to engineering design and inspection work. This comes out to just slightly over 6% for engineering.

Therefore, in this "updating" of the figures of the task force report, we find that 6% for engineering (not including any AEC overhead) is actual cost on a major project undertaken at cost plus a fixed fee of $1. If duPont had engineering costs of 6% on a $1.4 billion AEC job, it is hard to see how some of the engineers working for the Commission between 1950 and 1955 managed to make any money at fees amounting to less than 0.5%.

The conclusion is that an updating of the figures the task force gave for Atomic Energy Commission engineering costs would result in a considerable increase over the 5.23% figure presented in the report. This is only proper, for no engineer could possibly break even on the ridiculously low AEC fees shown in the records of the task force.

Navy Bureau of Yards and Docks

The published table shows the Navy Bureau of Yards and Docks with 352 active projects during the fiscal year 1954. The Bureau had 2627 persons on its engineering and construction staff and shows a figure of 8.17% of construction cost for engineering service. Again, the archives come forth with some interesting data, this time in the form of a letter from Commander R. R. Graham, Assistant for Construction Programs and Statistics, to Mr. T. R. Thornberg, of the task force staff. This letter stated that the 8.17% should be revised slightly downward to 8.04% on the basis of some later figures, but quite properly, Commander Graham says he does not feel that this difference is enough to require a change in the report. He does explain where the figure comes from. It involves "an average administrative cost of 3.80% on a total program basis." He also provides the figure of 3.86% for A/E (architect-engineer) services and 0.38% for military pay.

In another document the Navy Bureau of Yards and Docks tells Mr. Thornberg that the cost of A/E services provided for new construction projects averages about 4% of construction cost. Some typical Navy A/E contract figures are quoted, and they run 3%, 1.87%, 6.07%, and 1.75% for projects of varying complexity and varying size.

There is another document that shows engineering cost for work done on some Bureau of Yards and Docks projects – airfields, barracks, and warehouses – by government employee engineers instead of by A/E contract. This gives an average of 6.1% for this particular group of projects, but this includes administrative cost as well as design and supervision of construction. It is to be noted that this 6.1% for work done with government forces cannot be compared with the "average of about 4% for work done under architect-engineer contracts," for one figure includes Navy administrative cost while the other does not.

The conclusion is that the Navy is paying reasonable fees for engineering design work, and it is satisfied that the use of architect-engineers is a proper and reasonable practice of the Bureau of Yards and Docks. It is impossible, however, on the

basis of the figures available in the archives, to decide whether total engineering costs are higher or lower when the design work is done on A/E contract rather than by the Bureau's own engineers.

Corps of Engineers

The task force table shows that the Army Corps of Engineers has an engineering service cost of 12.15% of construction on its civil works. The same table shows for the Veterans' Administration a figure of 10.09% for 1947 through 1954 — including a high 17.8% for 1954 alone. Here it is interesting to examine related figures, collected by the task force staff, for the construction of about $700 million worth of hospitals. For those projects (designed between 1946 and 1954) design engineering (note that this is design only), expressed as a percentage of construction, was 3.96% for the Corps of Engineers, 5.96% for the Veterans' Administration, and 3.3% for A/E contracts. This is a really solid figure in favor of the independent architect and the consulting engineer.

In addition, this same data sheet shows that for these hospitals, the Corps' cost of supervision of construction was 4.3%, while that of the Veterans' Administration was a notably lower 2.68%. However, the Veterans' Administration's form of accounting was different and 1.45% more had to be added in the form of "engineering administrative cost." The total therefore adds up to 10.09% for the Veterans' Administration, the exact figure shown in the task force table. This must be compared with a 7.99% total for the Corps of Engineers for both design and supervision of construction — plus some unknown figure for administration.

The actual design cost comparisons of 3.96% for the Corps against 3.3% for A/E contracts indicates that on this type of project consulting engineers beat the Corps by about 0.6% on cost, and this is a fine figure for consultants to have in their favor. It is both believable and significant. It also should be pointed out that the Veterans' Administration's design costs of nearly 6% seem unreasonably high.

Bureau of Reclamation

In the task force table, the Bureau of Reclamation is given a figure of 17% of construction cost for engineering. This seems astronomical. The way that this breaks down is difficult to determine from the data available, but in one set of figures the Bureau of Reclamation indicates that its engineering can be subdivided into preliminary, design, and supervision. It says preliminary runs 2 to 6% of construction cost; design, 3 to 7%; and supervision of construction, 5 to 11%. It gives a partial example, the Hungry Horse Dam, where design was 4.27% and supervision of construction 5.29%. This seems high, but this is a complex project. At least it is better than the hydro project at Philpot, Virginia, done by the Corps of Engineers, where design came to 8.53% and supervision of construction to 3.62%. One should not conclude from this, however, that the Bureau of Reclamation should handle dam design while the Corps of Engineers should take over supervision. Percentage of construction cost figures alone are insufficient. They do not indicate type or quality of engineering involved, or special conditions relating to a particular project. Thus, this group of figures is of considerable interest, but no real value.

Tennessee Valley Authority

Actually, among all of the agencies, TVA comes out at the bottom of the list on engineering service cost figures. In the task force's archives, it is shown that the Fontana project, which cost nearly $60 million, included 4.80% for enginering design, 4.85% for supervision of construction, 7.04% for administrative and executive cost, and 2.51% for other general costs. This comes to 19.20%, a frightening figure, but TVA claims it ought to be credited with 2.78% for reasons that are not quite clear in the explanation provided. Even if that amount is deducted, the total is extremely high. However, it is to be noted that the most unreasonable portion is in the executive and administrative cost, and it is quite possible that this would go on at the same ridiculous rate whether the design and supervision were done by TVA's own forces or by consulting engineers. The percentages to be examined are 4.80% for design and 4.85% for supervision of construction. What a private engineering firm would charge for this it is hard to say, but these do seem rather high for a $60 million job. A study of fee schedules suggests that a consulting engineer would charge about half of this, his total fee for both design and supervision coming to about 5%. But to give the TVA devil its due, there still would be some design and especially some supervision costs for TVA

even if it used an outside consultant. What these costs would be, no one knows, but unless they were way out of line, there would be substantial savings to be had through the use of consultants.

TVA's Watt's Bar came out a bit better than Fontana. The figures for Watt's Bar show 5.55% for both design and supervision, with 3.90% for executive and administrative cost and 2.80 percent for other overhead. Actually, 5.55 percent is not too bad a figure for design and construction supervision. This is only one-half a percent over recommended minimum fee schedules commonly used for similar work by consulting engineers.

TVA, it seems, is inconsistent in its design and supervision costs from one project to another, and the variance is so great that it is doubtful that the same accounting procedures are being used. No doubt money could be saved by using consulting engineers for TVA designs. How much money, no one can accurately determine from the figures which are available.

To Sum It Up

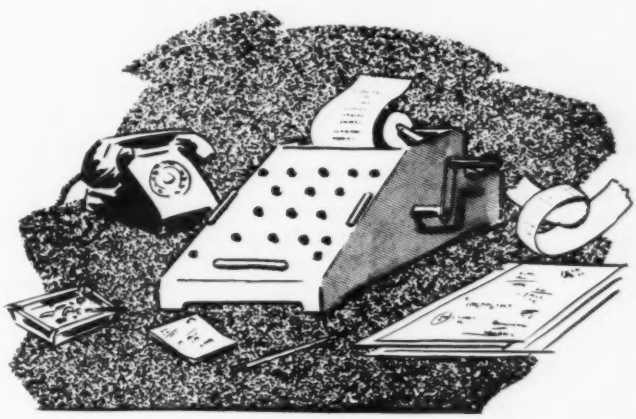
We find, then, that there is much more to this matter of "Hoover Commission Reports" and comparative costs, government vs. private, than most realize. It should be kept in mind that while there were two Hoover Commissions, one established in 1947 and one in 1953, neither ever reported on any aspect of government engineering or government engineering costs.

However, Robert Moses' Task Force on Public Works, reporting to the first Hoover Commission, and John R. Lotz's Task Force on Real Property Management, reporting to the second, did discuss engineering services on public works. Moses strongly supported the use of consulting engineers for many excellent reasons. The Lotz task force emphasized most the excessive costs of engineering done by government employees and recommended consulting engineers primarily on the basis of lower price. Neither of these task force positions were incorporated in the Hoover Commissions' own reports to Congress.

It also should be kept in mind that the actual published engineering cost data of the real property management group is generally worthless and even misleading as an argument in favor of the use of consulting engineers on government projects. There is some background material in the archives that is useful and could be said to constitute evidence in favor of private practice, but until now this vast store of material has been totally ignored by those interested in costs of government engineering. It is worth the time and effort that a thorough study would require.

But so far the whole approach has been wrong. It is logically absurd and ethically distasteful to compare engineering services on a dollar against dollar basis. Therefore, resolutions or policy statements recommending that professional services be put up on the auction block, the job to go to whoever (consulting engineer or government department) can do it at the least cost, are to be abhorred. Surveys and studies made to compare one against the other are improper. On the other hand, on government work, the Congress and the taxpayers have a right to know the costs on any project — not only construction costs but also the cost of associated legal, medical, engineering, or any other services. Therefore, it is perfectly within the province of Congress to inquire into engineering costs and only right that accurate and meaningful cost data should be made available to the taxpayer. Knowing costs is one thing. Purchasing of professional services by price tag is quite another.

Therefore, while Congress should insist on uniform accounting procedures and investigate waste or incompetence in engineering, whatever its source, no engineer or engineering society should recommend an "updating of the Hoover Commission Report" to simply permit price comparisons nor should surveys of charges be made for the purpose of providing comparative cost data. ▲▲



Private Practice

EVERY Wednesday and Saturday at 5 p.m. a Qantas Boeing 707 leaves Kingsford Smith Airport in Sydney on its weekly round the world flight. The same planes will be back in Sydney on the following Monday and Thursday, having girdled the earth. These twice weekly flights around the world typify the spirit and progressiveness of Australia today.

CE exclusive

The average American knows little about Australia. The Continent has a land area of 2,974,580 square miles, making it almost as large as the U.S. It has a population of 10 million people, with Sydney and Melbourne, the two principal cities, having populations of 2 million and 1.5 million respectively. A Federal-Commonwealth form of government embraces the States of New South Wales, Queensland, Western Australia, Victoria, Tasmania, South Australia, and the Northern Territory. But the States are far more independent of the Federal government than is the case in the U.S. In fact, in dealing with engineering works in a particular Australian State, only the State's rulings usually apply.

Being a member of the British Commonwealth of Nations, Australia's main ties naturally are to England. This is particularly true because most of the original capital invested in the country is British. However, the Australian is also well acquainted with the U.S. The result is an excellent mingling of British technical ability with American progressiveness. More and more Australians are visiting and studying in the U.S., and American manufacturing and engineering firms are, in turn, taking a greater interest in Australia.

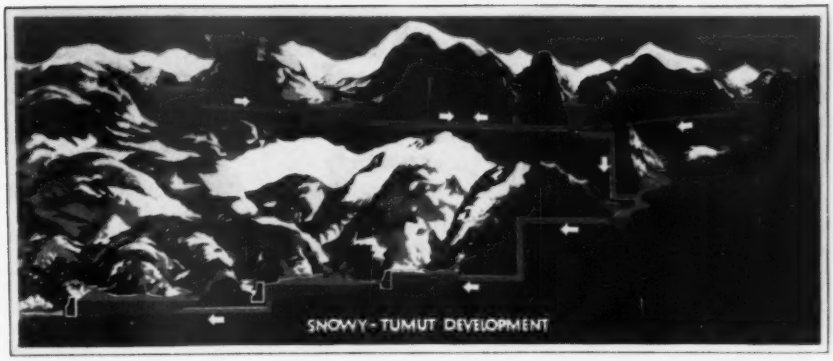
Construction Work at High Level

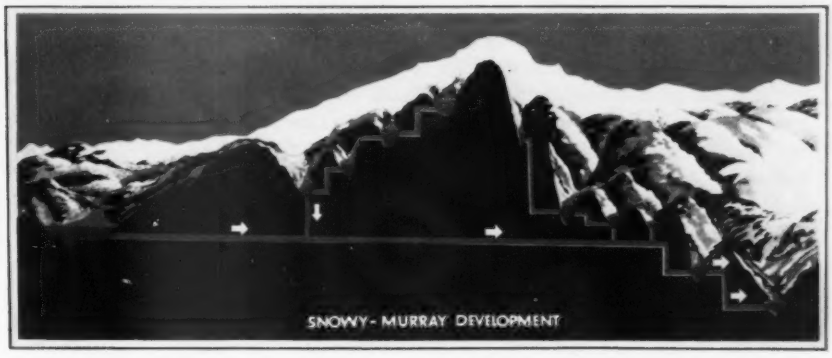
Currently, Australia's Snowy Mountain hydroelectric scheme is one of the largest civil engineering works under construction anywhere in the world. This vast project, taking shape in the Snowy Mountains between Sydney and Melbourne and the States of New South Wales and Victoria, will provide approximately 3 million kw of hydroelectric power from several under ground power stations. It also will provide approximately 2 million acre feet of water for irrigating presently barren lands.

The finding of minerals, including uranium, has helped to boom the Australian economy. Steel requirements are being met from domestic mills and local iron ore resources, with a surplus for export.

Down Under

JOHN K. M. PRYKE
Slocum & Fuller





Snowy-Tumut, above, involves 50 miles of tunnels and five power stations. Snowy-Murray, below, will have 30 miles of tunnels and ten power stations.

Increased transportation facilities, particularly into the more inaccessible but mineral rich areas of the country are being built. A well known U.S. consulting firm – Ford, Bacon & Davis – is redesigning the 300-mile Mt. Isa railroad.

Sydney and Melbourne are busy, bustling cities, with tremendous commercial building construction programs and a rapidly expanding development of light industry. In Sydney alone, at least 13 major office buildings are currently in the projected or planning stages. These buildings all are in the cost range of $2 to $12 million, and all will be large multistory structures.

The greatest area for development is around Sydney Cove, an inlet of famous Sydney Harbor, located quite close to the south end of the giant Sydney Harbor bridge. Reputed to be the second most beautiful in the world (Rio de Janiero comes first), Sydney Harbor is some 40 miles in length, and honeycombed with bays and inlets around which the City of Sydney is built. It can be said literally that the center of Sydney is its harbor. The view down its length under the early morning sun is truly unforgettable, and the enormous steel arch bridge straddling the harbor center dominates the entire scene. Sailboats dot the waters, ferries ply busily back and forth, and great ocean liners and large freighters sail majestically to their appointed docks and wharves.

Sydney Cove was the site of the first landing of the original settlers. Today it contains the major ferry terminal for the city and is backed by the fine broad sweep of Circular Quay. One arm of the Cove juts out into the harbor, and on this promontory is to be constructed the new Opera House designed by the Danish architect Joern Utzon. This building is scheduled to cost over $6 million.

Further back into the Cove stands the glass faced 11-story Unilever House, headquarters of Lever Brothers of Australia. Still further back stands the ICI building housing the New South Wales offices of Imperial Chemical Industries, and a new 19-story office building also is projected for construction nearby.

On Circular Quay itself will stand the new 26-story Australian Mutual Provident Society head office. This building, the first skyscraper constructed in Australia, will be some 375-ft high. It will cost about $14 million, and its design and construction standards are comparable with those of the finest

buildings in the U.S. (see page 176). Completion of construction is scheduled for June 1961.

In the city proper, a 1000-room hotel is rising, three large headquarter buildings for some of the major banks are projected, and many other commercial buildings are planned or under construction. Today it would be hard to find another city of comparable size where more construction is proceeding. And it is well to note that construction costs, with high labor rates prevailing, are almost comparable with those in the U.S. Fees charged by consultants also are comparable with those in this country.

Architectural-Engineering Activity

All of this means that Australian architects and engineers are very busy. On the architectural side there are many large, well established firms. Many of these have headquarters in either Sydney or Melbourne, with branches in the other major cities of the country. Some have offices in New Zealand as well. The largest one employes over 300 designers and draftsmen. However, well trained architects are hard to find.

On the engineering side, there are several good firms, but their status and reputation is not yet comparable with that of similar firms in the U.S. Thus, there is a tendency to go abroad for consulting engineering services. The reasons for the slow development of consulting practices are:

¶ There is a severe shortage of good engineering schools and hence good college trained engineers in Australia. Many of the Australian engineering college graduates must complete their training abroad, either in England or the U.S., if they are to produce work comparable to that of foreign engineers. Thus, much reliance for engineering manpower still must be placed on England or other countries.

¶ The demand for mechanically and electrically complicated commercial structures developed fairly recently. As a result, the engineers have had only limited experience in the design of large, modern air conditioning installations, for example.

¶ The prevailing practice is still one of relying on the combined contractor-engineer or manufacturer-engineer not only to construct and install mechanical and electrical equipment, but also to design and engineer it as well.

In the field of large commercial buildings, Australia is approximately 12 years behind America. For example, the perimeter system of air conditioning for large glass and metal skinned buildings is just being introduced. The AMPS building will be the first to have a modern perimeter system installed. A locally designed system has been placed on the market, and it is being installed in some of the new buildings. However, no practical working

New 26-story AMPS building is Australia's first skyscraper. It will have 500,000 square feet of floor area.

experience with this system – an all-air type – has yet been obtained.

Designed lighting intensity is still, on the average, less than half that used in the U.S. Also, both Sydney and Melbourne have ideal climatic conditions for heat pump applications. Unfortunately, no large installations currently exist, although both the new opera house and the AMPS building will have them – the latter with a capacity of some 1400 tons.

The Australian procedure which utilizes the services of the combined contractor-engineer or manufacturer-engineer, is really a carryover from the days of less complex mechanical and electrical installations. The British influence is also apparent here, for architects used a similar approach in England right up to the outbreak of World War II. Under this system many large contracting firms employ their own engineering staffs and carry out their own design work. Even today this practice is far from unknown in Europe – or the U.S., for that matter.

Methods for Awarding Contracts

The employment of a quantity surveyor is another common Australian practice. Practically unknown in the U.S., the function of this individual is to measure and price the construction costs of the works. In England and Europe the quantity surveyor is an equally important member of the design team with the consulting engineer and the archi-

tect. So, too, in Australia. Several of the larger English firms of quantity surveyors have branch offices in Australia and operate in exactly the same manner as they do in England.

Just as soon as plans and specifications for a building are completed, they are sent to the quantity surveyor. He proceeds with a quantity take-off, and, on a unit price basis, estimates the cost and prepares a Bill of Quantities. If certain items cannot be fully determined at this point, as for example the exact design of an emergency motor generator set, they are listed under the heading "P.C." (Provisional Costs). For these items a lump sum cost is allowed, or as it would be known in America, a "lump sum allowance."

From the Bill of Quantities the budget cost of the building is determined. Then either of two procedures may be adopted. One is to send plans and specifications and the Bill of Quantities out for competitive bids – known as tendering – in which case the bidding contractors are entitled to use their own unit costs but must keep to the quantity take-off. The other is to negotiate a direct contract with a general contractor on the basis of the Bill of Quantities. With either method, the Bill of Quantities is written directly into the final contract.

Frequently, the architect's plans and specifications will not include mechanical and electrical drawings, sections, or details. For these portions of the work, however, a performance specification will be included, and the Bill of Quantities will include P.C. items for the major components. This enables the general contractors to get prices from the specialty contractor-engineer firms that then are included as part of the general contractors' bids.

After the contract is let, the successful mechanical and electrical subcontractor-engineers prepare their own plans and specifications. Their Bills of Quantities then become the bases of their contracts. All cost adjustments due to extras or omissions in the original contract are worked out on the basis of the unit prices for each trade contained in the Bills of Quantities.

This procedure introduces a third member of the professional team who acts strictly on the building owner's behalf as a specialist expert, in the same way as the architect and consulting engineer. The quantity surveyor actually measures the building for individual quantities used, as it is being constructed. Thus, an excellent system of checks on the contractor's work is introduced.

Subcontracts Remain a Problem

It should be noted, however, that to obtain optimum results properly detailed plans and specifications for the mechanical and electrical systems must be produced by the consulting engineer as part of the architect-engineer's original documents. Where only performance specifications are used, the bidding on the mechanical and electrical installations in a complex commercial building is most unsatisfactory. This is due to the fact that every bidder can produce his own basic design, and there is no uniformity in the bids received.

Consider the case of the air conditioning installation for a large building. There are many different ways in which such an installation can be designed. Naturally, any contractor-engineer or manufacturer-engineer bidding on a performance specification will submit a system design best suited to his own interest. Thus, of seven bids recently received for the air conditioning installation of a large multistory building in Sydney, no two were even remotely alike in technical design approach.

This situation is neither fair to the contractors nor to the building owner, and has had two unfortunate results. First, the average quality of air conditioning installations in many sizable buildings leaves much to be desired. The acceptance, through ignorance, of bids covering undesirable designs for a particular application has resulted in the fairly common saying, "Air conditioning just will not work in Australia." Complaints of the malfunctioning of installations are widespread, and the position is doubly unfortunate in view of the fact that the climatic conditions over much of the country certainly call for summer air conditioning.

The second unfortunate result reflects on the status of the consulting engineer. His reputation as a technical design expert in the commercial building field is not too enviable. In fact, the Australian consultant is some 20 years behind his American counterpart in prestige and reputation. Well established, first class firms are few and far between. Many of the engineers rely too heavily upon manufacturers and contractors without checking their products and designs. There is a severe shortage of designers, draftsmen, and engineers, and there is no licensing system to maintain a proper standard among engineers in private practice. ▲▲

Over-all Design of a Reactor Plant

The design of a nuclear reactor plant is a complex integration of several variables into an acceptable core. The primary effort would be expended on the thermal design of the power reactor proper and would follow the sequence outlined below:

1. Select moderator, cladding, coolant.
2. Make an estimate of plant efficiency, to determine the desired core output.
3. Select the values of Q and ΔT required for the cycle.
4. Select W ÷ Q, the percentage of the reactor output that will be used for pumping.
5. Determine the heat generation pattern, giving consideration to the control and configurations in the core and the hot spot factors. Determine the peak to average power factor.
6. Determine the percentage of core to be used for passage of the coolant based on considerations of the critical mass requirements of the core.
7. Calculate the flow area required.
8. Select a core length.
9. Calculate a value for the hydraulic diameter of the coolant channel.
10. Determine the number of fuel elements required.
11. Determine fuel element diameter.
12. Determine the weight of the fuel required.
13. Determine the actual size of the fuel channels. If the estimated value is not consistent with the required value, rework the previous steps.

The final step is to determine the steam plant parameters, and perfect the entire calculation by repetition, formula, or computation.

Five Critical Factors of Nuclear Plant Design

PAUL N. GARAY
Kaiser Engineers

CE exclusive

A SUPERFICIAL comparison of nuclear power plants with conventional fossil fueled plants might suggest that a nuclear plant differs little from a fossil fueled plant. A nuclear reactor replaces the conventional boiler as a primary heat source, and some concessions must be made to the variety of cooling media used in transporting the nuclear produced heat to the power generating cycle – but basically, that is it.

This generalization has a limited validity, but is completely inaccurate as an indicator of the nature of the problems encountered in the design of nuclear plants. Actually, there are five critical factors which create design problems that differ sharply in magnitude and character from those faced in the design of conventional thermal plants.

Unlimited heat output – It is in the nature of a nuclear reaction that there is no limitation on the heat output of a reactive core. If there is a sufficient quantity of fissionable material available to create a critical mass, the thermal output of a core is limited only by the techniques and materials which are available for removal of the heat produced. The size of a core, nuclear considerations aside, is

of interest chiefly as an indication of the amount of heat transfer surface it can provide.

Reactivity and what it means – A reactor operating at steady state conditions, at any power level, produces one replacement neutron for each neutron which is absorbed by the core elements, or lost. The multiplication factor is said to be 1. If, however, conditions favor the propagation of neutrons, and 1.005 neutrons are produced to replace each absorbed or lost one, the multiplication factor becomes 1.005. The increase in the total number of neutrons in any time interval is dependent on the multiplication factor raised to an exponential value depending upon the number of neutron generations occurring in a given span of time. For instance, with a multiplication factor of 1.005, if one generation of neutrons is produced every tenth of a second, at the end of a one second period the quantity of neutrons (and the corresponding power output) will have increased by a factor of 1.005^{10}. (This description neglects the contingent nuclear effects which modify the neutron production rate.)

It is fortunate that in a thermal reactor (one in which neutrons are slowed, or moderated, to speeds corresponding to thermal agitation), a generation of neutrons is not complete until several delayed neutrons have been emitted, at delay periods which may be as long as 30 seconds. This interval during which the delayed neutrons are pending provides enough time to insert a control rod that will control the succeeding reactions.

If the excess reactivity is allowed to increase to about 1.007, the reactor becomes "prompt critical," which means that sufficient prompt neutrons are being produced to maintain the chain reaction. Prompt neutrons have extremely short lives, about 1/50 of a second, so if a reactor exceeds prompt criticality by 0.0005, the power may increase by a factor of 1.0005^{50} in one second.

In practice, the control rods of a reactor are built so that the sudden and complete withdrawal of any individually controlled rod (or group of rods) will not cause prompt criticality. In addition, the control functions of a reactor must be sufficiently precise to permit variation of reactivity in very small increments, and they must act fast enough to accomplish the required changes within the short time factors allowed. The excess potential reactivity built into cores may be in the order of 10 to 12 percent (to compensate for fuel depletion and fission product poisoning), but the control of these thermal reactors is readily possible because of the delayed neutron fraction. Control is enhanced by built-in design features that damp out variations in reactivity. Fortunately, a properly designed nuclear power reactor is inherently incapable of approaching a bomb type reaction; it is possible, however, to conceive of a multiple-factor power increase that would destroy the core by melt down or vaporization.

Radiation effects – Radioactivity from a reactive nuclear source affects the design in two distinct ways. First, it calls for expensive shielding for the protection of personnel and elaborate provision for containment of activated materials. Second, the materials of the nuclear reactor are subject to radiation-induced degradation and alteration. Metals are embrittled, organics may become useless, the value of electrical insulation is reduced, ionization effects alter the characteristics of vacuum tubes and their associated circuits, and deleterious temperature and aging effects are accelerated.

Decay heat – During operation of a reactor, the fission of each atom results in the formation of two fission product atoms. These are highly unstable and decay through a chain of radioactive events (with the accompanying emission of electrons, neutrons, and gamma rays) until a stable ground state is attained and the activity ends. Of the total heat output of a steadily operating reactor, about 6 percent is due to the absorption of the radiation emanating from these fission products. The evolution of heat from fission product activity continues after reactor shutdown, requiring about a day to diminish by one decade to a residual value. This decay heat must be removed after reactor shutdown, else the core may suffer extensive damage – even melt down. Elaborate precautions must be provided in a nuclear plant for the removal of decay heat.

Unique hazards – While an explosion in a conventional power plant may result in loss of life and extensive property destruction in its immediate vicinity, a nuclear plant accident may become a threat to the well being of the population for miles around, and the secondary effects of an uncontrolled radioactivity release may be evident for several generations.

The nuclear plant engineer, therefore, is required to design his installation so that the possibility of an uncontrolled release of radioactivity approaches zero. The remotest possibility of contaminating the surrounding environment must be examined and preventive measures devised – not on the basis of personal opinion but on statistical probability.

That designers have been successful in their safety efforts is indicated by the fact that in the U. S. there has not been a single incident involving the safety of a power reactor.

Differences in Design Approaches

Engineers who follow technological advances in this field are familiar with the possibilities of the various thermodynamic cycles presently being con-

sidered for nuclear applications. However, differences between concepts which appear to be generally similar may not be immediately evident. Table 1 explains some of the conditions to which existing plants are designed.

The physical differences between water, liquid metal, organic, and gas cooled reactors are readily apparent even if the economic and technical considerations are not. A study of Table 1 is indicative of the parameters that govern the evaluation of

Table 1 — Comparative Data, Liquid Cooled Reactor Plants

Plant	*Net Plant Efficiency %*	*Heat Flux Btu/hr-sq ft*	*Average Burnup*[1] *MWD/MWT(U)*	*Max. Primary Cooling System Press. & Temp. (psi & °F)*	*Max. Throttle Steam Press. & Temp. (psi & °F)*	*Average Power Density in Core*[2] *Kwt/cu ft*
Pressurized Water (PWR)	25-28	450,000	15,000	2200 & 550	570 sat.	1300-1600
Boiling Water (Natural circ.) (BWR)	27-30	350,000	13,000	1050 sat.[3]	1050 sat.	550-750
Boiling Water (Forced circ.) (BWR)	28-31	350,000	13,000	1050 sat.	1050 sat.	750-950
Boiling Water (Dual Cycle)	28-31	350,000	13,000	1050 sat.	1000 sat. (PRI.)[4] 500 sat. (SEC.)	750-1000
Organic Cooled & Moderated[5] (OMCR)	32	150,000	15,000	50 & 675	1000 & 650	750
Organic Cooled & Moderated[6] (OMCR)	28	150,000	7,000	50 & 600	600 & 550	400
Sodium Cooled Graphite Moderated (SGR)	32-34	400,000	3,000	0.25 & 950	800 & 825	130-350

1. Megawatt days/megawatt ton of uranium
2. Thermal kilowatts/cu ft of core volume
3. Saturated steam
4. Note that dual cycle has a primary and a secondary steam flow
5. Nucleate boiling allowed
6. No nucleate boiling allowed

Characteristics of Reactor Plants

PWR — This system uses a pressurized water cooled core, transferring heat to a secondary steam system, which then provides saturated steam for the operation of the turbine generator.

BWR — This is a direct cycle in which the saturated steam used to operate the turbine generator is formed by boiling of the primary coolant (water).

Dual Cycle — This cycle is used in the Dresden and the Senn (Italy) reactors. High pressure saturated steam formed by boiling in the core is used directly in the high pressure section of the turbine-generator. In addition, a portion of the saturated water in the main reactor vessel is put through a heat exchanger to provide a secondary steam flow at lower pressure. The secondary flow supplements the steam requirements of the intermediate stages of the turbine generator (which is a dual admission unit).

OMCR — This is a cycle in which an organic liquid is used to moderate and cool the reactor. The high temperature, low pressure characteristics of the organic, liquid, as well as its noncorrosive character, favor a low cost primary system. The heated organic liquid is passed through a heat exchanger and produces superheated steam for use in a conventional turbine generator.

SGR — In this cycle the favorable heat transfer characteristics and high temperature capability of liquid sodium transfer heat from the core to the power generating machinery. Graphite is used for moderating.

The primary coolant (sodium) loop transfers its heat to a secondary (sodium) loop; the secondary loop is the heat source for the production of high pressure superheated steam for use in a conventional turbine cycle.

The intermediate or secondary sodium loop is provided to limit the radioactive influence of the highly radioactive sodium to the area of the primary loop; and to insure that in event of leakage between the secondary loop and the water in the steam generator, the products formed would not be radioactive.

GCR — Gas cooled reactors may be cooled by any type of gas; CO_2, He, N_2, or other. They are graphite moderated and, to date, have used only the indirect cycle in which the heated gas produces high pressure superheated steam for use in a conventional turbine generator.

each concept. The distinctions between water cooled reactors are apt to be in the area of safety, ease of control, and convenience of size rather than in performances and cycle efficiencies. The more subtle differences dependent on enrichment of the fuel or type of cladding must be sustained by refined economic evaluations.

Water Cooled Reactors

There is one important characteristic water cooled reactors have in common: these reactors produce only saturated steam. Turbine generators have been designed for the past 50 years to operate on superheated steam, and they are reliable and efficient. The saturated steam turbine (in large sizes) has been a stepchild, being used only in special applications where high efficiency was not the primary criterion. The saturated steam produced by a reactor is never completely dry, and the turbine must be constructed to withstand the destructive erosion brought on by the entrained water.

The conventional steam turbine is designed so that the steam quality at the exhaust is about 88 to 90 percent; the steam velocity is low; and its specific volume is high. The saturated steam turbine, on the other hand, must be designed to handle the 88 percent quality wet steam at its high pressure, high velocity stages. The modifications necessary to adapt standard turbine designs to wet steam include special blading materials, hardfacing of blades, slinger rings, and moisture removal sections. If the moisture at the 88 percent quality stage is collected and removed at a feedwater extraction nozzle, no penalty is imposed on performance; however, if moisture removal fittings are required, about a 1 percent reduction in efficiency may be anticipated for each.

It can be seen that the necessity to use saturated steam in the turbine of a water cooled reactor plant places a serious limitation on the efficiency of the turbine cycle and introduces the need for erosion control and water removal in the turbine.

The concept of the boiling water reactor is extremely simple. It is the safest of all reactor types, for it cannot experience power surges which may, in other reactors, be of sufficient magnitude to prove disastrous. In the boiling water reactor, voids are formed in the core by the steam content of the water. The more heat, the more voids. Therefore, the reactor will shut itself down whenever excess heat is generated in the core. The simplicity of design and this inherent safety feature are the chief attractions of the boiling water reactor.

This type of reactor has its disadvantages. Load changes are accompanied by large pressure variations in the steam system, and external control is required to minimize these changes in pressure. The design also is limited by several other factors. Its power density (indicated in Table 1) must be fixed so that at no time will the reactor approach a condition of excessive boiling. All water cooled reactors utilize large volumes of circulating water through the core, so the actual weight of steam existing in the fuel channels is in the order of 5 percent of the quantity of water being circulated. If the boiling exceeds the design value substantially, steam blockage of the channel may occur, and the fuel element will burn out. An ultra conservative approach to the solution of heat transfer problems must be observed.

All water cooled reactors require pure water in the primary cooling system to avoid corrosion of the core and reactor elements; to minimize the deposit of solid material on the fuel elements; and to reduce the quantity of suspended or solid material, which may become irradiated in its passage through the core and thus spread radioactivity thoughout the whole plant. Since the primary loop is the entire loop of a boiling water reactor (direct cycle), the entire flow from the power plant condenser must be purified by demineralization.

In a direct cycle system, a defective fuel element may contaminate the cooling water and be carried over by the steam into the power system. If that happens, the entire plant may be seriously affected. Fortunately, experience with reactors of this type has shown that turbines and steam systems remain gratifyingly free of contamination as long as the fuel elements maintain their integrity. Finally, it should be noted that the boiling water type usually requires shielding and exclusion areas around the turbine machinery as well as around the reactor complex, for the steam will exhibit some short term activity during operation of the plant.

The primary system of a pressurized water reactor is maintained at so high a value that only incipient nucleate boiling can occur. As a result, heat transfer rates in the core are higher than for an equivalent boiling water type, and the core may be made more compact. Since the coolant water is contained within a closed primary loop, shielding of the turbine is not required, and side stream demineralization is adequate as treatment for the primary cooling water. The water flowing in the secondary or power system may be treated just as it would be for a modern steam power plant. Because of the isolation between primary and secondary circuits, contamination of the reactor cooling water is not spread to the power plant but stays in the normally shielded primary loop. Shielding is not required for the turbine plant.

As might be expected, the attractive features of the pressurized water reactor are balanced to some extent by a number of less attractive features: a

large, expensive heat exchanger is required; an elaborate pressurizer system must be used; and start-up accidents are possible for this type reactor does not have the inherent safety characteristics of the boiling water design. The weightiest objection to the pressurized water cycle is the low steam pressure at which the turbine must operate because of the pressure differential betwen the primary and the secondary systems. A pressurized water reactor with a 2000 psi primary pressure and a boiling water reactor generating at 1000 psi pressure may both supply saturated steam to the turbine at about 900 psi.

The pressurized design depends upon its negative coefficient of reactivity to regulate power output. One method of control is to vary the speed of the primary circulating pumps in accordance with load changes; the thermal output of the reactor then will be responsive to the average coolant temperature. This control method is simple and results in adequate load following capability with a minimum amount of rod adjustment.

In an attempt to combine the compact core and good control characteristics of the pressurized water reactor with the inherent safety, the simplicity, and the high steam pressure characteristics of the boiling water reactor, General Electric devised the dual cycle, of which the Dresden and Senn plants are likely to be the only two examples.

The dual cycle does have the advantages of both parent concepts, but it also adds together the contamination and boiling problems of the one with the heat exchanger problems of the other.

Superheated Steam Reactor Plants

Three principal design approaches to solve the problems associated with the necessity of using saturated steam turbine power cycles have been considered. They are:

¶ The use of an external oil or coal fired superheater for saturated steam from a boiling water reactor.

¶ The use of a nuclear reactor having a two region (multiple pass) core, which generates saturated steam from a boiling water section of the core, then superheats this steam in a separate section of the same core. The successful design of a core that will be balanced at all conditions, and the solution of the physics problems arising from a nonuniform core configuration are presently being evaluated.

¶ The use of a Loeffler cycle is particularly interesting because this reactor is, in effect, a gas (steam) cooled reactor, and as such, its problems are amenable to the technology of gas cooled reactors. Fig. 1 illustrates the cycle. It will be seen that the superheated steam produced by the nuclear reactor is divided into two channels, one of which supplies the turbine plant, while the other is used to evaporate water and produce saturated steam which then is passed through the reactor.

Corrosion resulting from water in the reactor vessel, contamination of the liquid coolant, the necessity for extreme water purity, and excessive

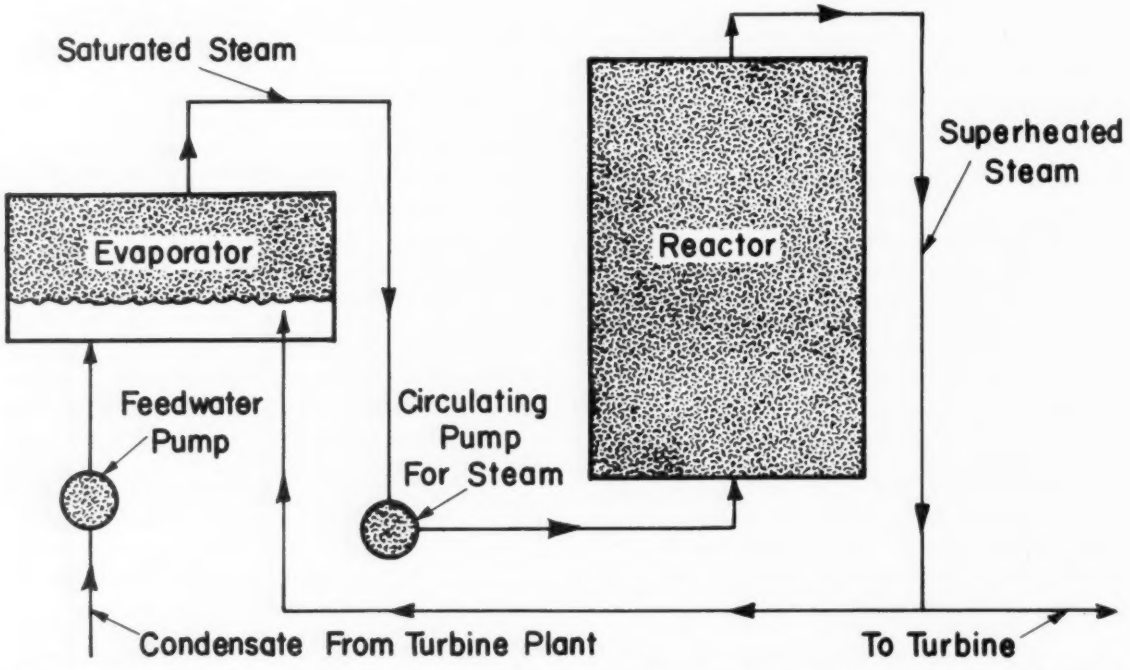


Fig. 1 — Loeffler cycle uses steam to cool the reactor. This eliminates some problems of boiling water reactors.

boiling in the core are significant problems in boiling water reactors, but they are not encountered in the Loeffler concept. This cycle has been proposed for marine propulsion, but no plants have been built. As experience is gained in the use of steam as a reactor coolant, the design should become popular.

Organic Cooled Reactors

The organic cooled and moderated concept has long been an attractive prospect, using as it does the high temperature, low pressure primary coolant to produce high temperature, high pressure super-heated steam in the secondary loop. With this cycle, standard steam plant components can be used. The organic moderated and cooled experimental reactor at NRTS uses carbon steel for both primary and secondary loops and is adequately served by pumps and auxiliary equipment of a commercial grade. Containment is not used, and the primary system is designed for relatively low pressures of about 400 psig.

The practical success of this concept presently depends on the solution of the physical and economic problems involved in purifying the primary coolant, which deteriorates in the radiation field of the core. The possibility of the decomposed coolant coating up the fuel element surfaces also must be evaluated before large reactors of this type can be confidently designed.

These plants must be designed with elaborate purification systems for the primary coolant, and even so, a considerable inventory of the organic liquid will be used up daily in any sizable operation. At present one of these reactor concepts in which nucleate boiling is allowed will have good burnup and high power density, but a tendency to foul the fuel plates may be anticipated. The nonboiling organic moderated and cooled concept is expected to have poor burnup and low power density, but the fuel plates remain clean.

Gas Cooled Reactors

The theoretical gas cooled reactor concepts have included both direct and indirect cycles. The direct cycle, although attractive in theory, is not built at present, since the cycle is advantageous only at temperatures above 1400 F. A 1400 F gas temperature would mean fuel element surface temperatures of 1700 F, conditions for which we are not yet prepared. A high temperature, high pressure steam cycle is as efficient as the direct gas cycle in our present design pressure and temperature ranges. Yet, this direct cycle is simple, and it would seem to be preferable to the indirect systems used in England – if we are willing to deal with the high temperatures that are involved.

The indirect gas-steam cycle will yield conversion efficiency competitive with conventional steam plants when using gas pressures of 400 psig and temperatures of 1100 F. Even the indirect cycle, however, is economically hampered by the substantial cost of the large heat exchanger that is required to generate steam.

The U. S. Maritime Administration recently announced a design for a closed cycle, direct, gas cooled reactor for marine propulsion. This cycle is restricted, as are all gas cycles, by operational problems. It is difficult to maintain full efficiency over a range of 50 to 100 percent power with a direct coupled turbine-blower combination. In order to maintain peak efficiency at varying loads, the system pressures in the circuit must be altered to suit the output power requirements. In addition, rapid startup and load change can only be satisfactorily accomplished by varying the volume of thermodynamic gas in the system. Even so, during power changes, compressors can stall, and compressor surge conditions can occur.

A direct cycle gas plant which will maintain satisfactory performance characteristics requires, it would seem, the use of a turbine and a blower that can be varied in speed independently.

Another significant problem of gas cooled reactor plants is the cost of gas lost through leakage. In a carbon dioxide plant, this cost is moderate, but in a helium cooled plant, the cost of lost gas per day may run into hundreds of dollars.

Design Criteria

In determining an optimum reactor plant cycle, the best economic conditions will result from coordinating these design factors:

¶ Simplicity
¶ Control response
¶ Safety
¶ Heat transfer efficiency
¶ Thermodynamic efficiency
¶ Pressure and temperature conditions
¶ Radioactivity hazards during normal operation
¶ Effect of fuel element failure
¶ Normal operation contamination of thermal plant
¶ Pumping costs
¶ Material and corrosion problems
¶ State of the art considerations
¶ Costs associated with system components
¶ Waste disposal
¶ Site requirements

A question frequently asked is "why don't we pick the best coolant and develop it to the limit?" The answer is that there is no best coolant. The selection of any cooling medium depends on a complex evaluation of many factors. Even within general categories of coolants, there are great differ-

Table 2 — Performance Variation for Different Coolant Gases

Gas	*Thermal Output MW*	*Horsepower Per Blower*	*Outlet Temperature °F*	*Can Temperature °F*	*Electrical Output Gross MW*	*Net MW*
He	700	6000	1000	1200	251	222
CO_2	700	8000	880	1200	231	197
H_2	700	3000	842	980	226	206
H_2	700	2050	1020	1200	251	234
H_2	990	3000	1004	1200	355	331

ences. For example, the criteria for the choice of a cooling gas are:

¶ Heat transfer and thermodynamic properties
¶ Pumping power requirements
¶ Nuclear properties (effect on gas of radiation, neutron absorption properties, stability)
¶ Chemical properties
¶ Cost
¶ Availability
¶ Purity

Table 2 illustrates the wide range of performance possible in one reactor plant design as adapted to several gases. Further investigation to determine an optimum choice of a gas coolant would involve the compatibility index between the gas and the fuel component materials as well as the more commonly understood reaction with metals.

Liquid metals are superior to both gases and water in that high heat transfer rates, low primary system pressures, and high temperatures are readily attained. The criteria for selection of liquid metal coolants is different from that for gases. The important factors are:

¶ Low melting, high boiling point
¶ Low cost
¶ Minimum chemical reactivity with metals or air
¶ Low neutron absorption
¶ High heat transfer
¶ Low pumping power requirements
¶ Suitability for moderating
¶ Thermal stability
¶ Low induced radioactivity
¶ Low solubility with core and vessel components

The liquid metals commonly used for cooling are shown in Table 3. Water and organic compounds also are included for comparative purposes because these fluids are the least difficult coolants with which to work in reactor plant design . ▲▲

Table 3 — Liquid Metal Coolants

Coolant	*Melts °F*	*Boils °F*	*Heat Transfer Coefficient Btu/hr ft deg*	*Limitations*
			Elements	
Na	208	1621	9900	Requires intermediate loop
K	147	1400	7100	Requires intermediate loop
Li	354	2403	6330	Requires intermediate loop. High neutron absorption
Bi	520	2691	4420	Physiological hazard of Po^{210}
			Alloys	
NaK[1]	66.2	1518	5820	Requires intermediate loop
Pb-Mg[2]	480		4440	May require intermediate loop
Pb-Bi[3]	257	3038	3920	Physiological hazard of Po^{210}
			Water and Organic Compounds	
H_2O	32	212	5970	Requires pressurization
D_2O	38.87	214.7	5970	Requires pressurization. Very high cost
Dowtherm	53.6	495.8	2630	Thermal decomposition occurs above 750 F. Subject to radiation damage. Requires some pressurization
Biphenyl[4]	160	489	2630	

1. 56% Na, 44% K 2. 97.5% Pb, 2.5% Mg 3. 44.5% Pb, 55.5% Bi 4. Typical organic material

Meet an expert in light construction—There's no finer example of light construction than this familiar orb web spun by a common garden spider. The spokes and spirals are whisper-light, but stronger than steel wire of the same diameter. The spider has an economical advantage; he makes his own building material, and nobody knows exactly how to duplicate it. ☐ For strength, lightness and economy with the best structural material man can devise, we suggest USS AmBridge Steel Joists, both standard and longspan, for light occupancy structures. They provide strong, lightweight and economical construction suitable for any type of roof, ceiling or floor. AmBridge Joists have an underslung, open-web design for maximum headroom, and to accommodate pipe, ducts and conduit in all directions. AmBridge Steel Joists are easy to install. And once in place, they make a safe working platform. Want more information? Write to our Pittsburgh Office for your free copy of a 40-page catalog.

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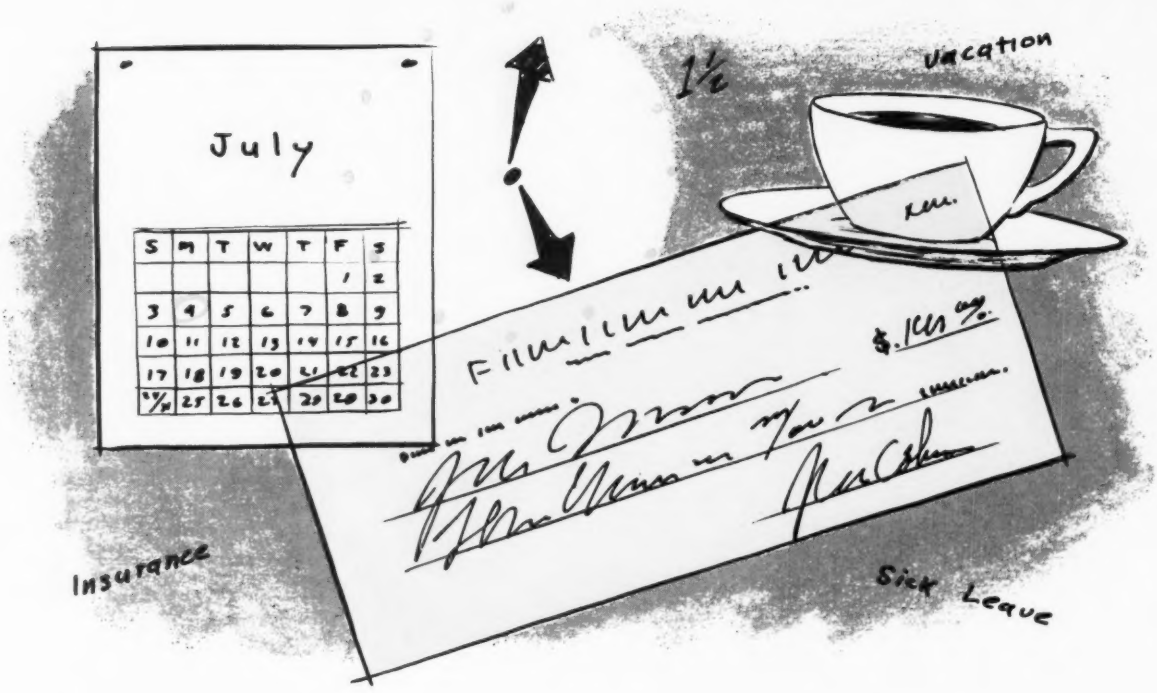


WOULD YOU be surprised to discover that a fellow consulting engineer had expressed great concern over the amount of time his employees spend on coffee breaks? Hardly! But it might surprise you to discover that – one consulting firm pays a $1000 bonus to an engineering employee when he becomes registered – one expressly prohibits the use of intoxicating liquors during office hours – one pays a bonus to employees who bring new accounts into the office – one encourages its own employee engineers to get out and open their own offices – and one pays a monthly bonus for work "above and beyond the call of duty."

CE exclusive

These interesting bits of information came from a recent nationwide Employer-Employee Relations Survey conducted by the Consulting Engineers Council, under the direction of the Consulting Engineers Association of Georgia. Of the 431 consulting engineering firms participating in this survey, 23% were from the California Association, 7% each from Minnesota and New York, and 6% each from Illinois and Michigan. Other associations and the members-at-large each represented less than 5% of the total.

Stability Evident

Critics have long maintained that the consultant keeps a few key people during lean periods and then hires the floaters when he gets extra projects. The survey blasts this myth. A permanent staff based on average work load with added temporary employees as required was indicated by 75% of the respondents, 15% have permanent staffs based on their maximum work load, and less than 10% carry a staff based on minimum work, adding temporary employees for large jobs. Among those replying, 5% have no professional employees (other than themselves); 36% employ from 1 to 3 engineers; 38% from 4 to 10; 14% from 11 to 30; 6% from 31 to 99; and only 1% more than 100.

Questions related to interpretation of the Fair Labor Standards Act brought some interesting statistics and replies. Employees are classified and paid in accordance with the provisions of the Act by 56% of the responding firms, while 31% stated flatly that they do not do so. It may be assumed that the remaining 13% never heard of the Act. For the information of the Department of Labor – replies were blessed with anonymity.

Consulting firms generally consider professional engineers as salaried employees, and 70% of them compensate these registered engineers on a salary basis. However, overtime (based on an hourly rate obtained by dividing the basic weekly salary by the number of regular work hours) is paid by 36% of the consultants. One and one half times this amount is paid for overtime by 29%. Nonprofessional employees are paid on an hourly basis by more than half of the firms, and more than 90% of the firms pay them overtime.

The standard work week for 82% of the consulting engineering organizations surveyed is 40 hours. But 11% report 44 hours as their standard work

Coffee Break, Bonus, Or Both

BENJAMIN S. PERSONS
Dames & Moore

week, with the standard week for the remaining firms varying from a surprising 48 hours to an equally surprising 35.

Two weeks vacation after one year's service is allowed by 70% of the firms, one week after six months by 23%, one week after one year by 18%, and two weeks after two years by 13%. Apparently, the consultant feels that two weeks vacation is about all his employees ever need, for only 14% reported three weeks vacation for varying amounts of service, and less than 3% reported four weeks of vacation, regardless of length of service.

Between five and nine paid holidays per year are granted by 85% of the firms. Of these, 20% favor five hoildays, 31% six, and 22% seven. Holiday practice is rather standard for New Years Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving, and Christmas. However, Utah celebrates Pioneer Day on July 24th, there is a very strong feeling in New York and Baltimore for Columbus Day, and Confederate Memorial Day has a large following in the Southeastern States.

One of the survey questions was, "Do you have a formal sick leave policy?" A negative reply came from 56%, but this was qualified by extensive comments. Most of these indicated that the firms take care of their employees who became sick. In fact, a surprising number stated that in the history of their firms, sick leave had always been provided for as long as required.

Group health insurance is available in some form at 68% of the firms. It is paid for by the employees in 17% of these firms, by the firm in 28%, and jointly by the employees and the firm in 23%.

Bonus plans were reported by 51%, profit sharing by 25%, and a retirement plan by only 5%. Employees' performance and compensation are reviewed by 66% on a regular basis. This varies from the conventional annual review to a "continuous" review by a few firms.

On employee expense accounts, 94% pay all reported expenses, while 6% provide a set per diem. Mileage for employees using their own automobiles on firm business is paid by 77%. Going rates are seven cents per mile in 18% of the firms, eight cents per mile in 34%, and ten cents per mile in 21%. These mileage allowances vary from five cents to twelve cents.

Views on Registration

There was a great deal of added comment in answer to the question "Do you encourage registration?" Affirmative answers came from 95%. Most indicated some tangible evidence of their support. Extra compensation was frequently reported, such as a $300 to $500 a year raise, a 25c per hour raise, and a $1000 bonus. One firm encouraged registration by "exhortation." Another, "Bribed, cajoled, needled, and shamed," nonregistered but eligible engineers. One firm answered simply – "Never have"!!!! Another allows registered engineers to seal their own drawings. Still another makes registration mandatory for all who can qualify.

Consulting engineer firms appear to be reasonably lenient about time off. Engineering society activities and voting were allowed on the firm's time by 80%, personal business by 75%, and active duty in the military reserves and for service club membership by 40%. Half the firms allowed time to prepare for engineering registration, and 35% allowed time off for engineering school courses.

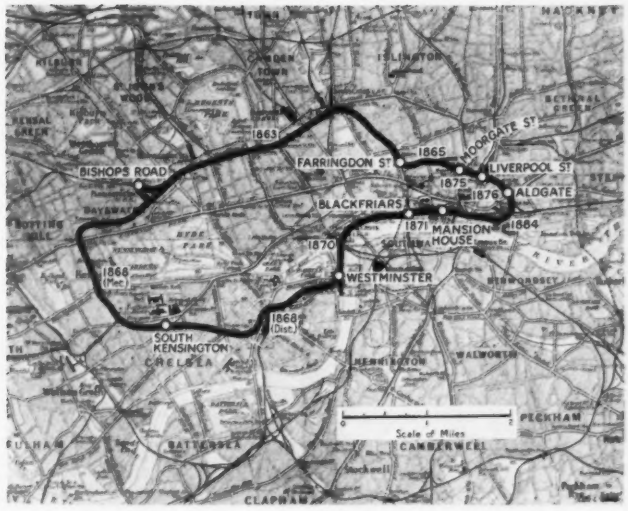
The engineering employee of the consulting firm appears to receive more understanding and career assistance in the small firm. Practitioners in the small offices are the ones who most frequently mentioned counseling, encouragment, and occasional assistance to employees interested in their own professional careers. These intangibles could, in large measure, negate the deficiency that may sometimes exist between the greater fringe benefits offered by the large offices.

The larger engineering firms offer benefits comparable to or exceeding those of government and industry. However, there is a noticeable aversion to the so-called "security" type benefits. Consulting firms prefer to give the employee all his benefits now – in cash and in work privileges that permit him to live a full life while he practices engineering. His future is his own problem. ▲▲

London's Underground—The World's

First Subway

F. C. LIVINGSTONE



The 13-mile Inner Circle of the world's first subway system, in central London, was built in sections over a period of more than 20 years.

A CENTURY AGO, London was faced with a traffic problem every bit as bad as that of today, when most of the main arteries and side streets are clogged with vehicles moving at little more than a crawl. But the cause of the congestion then was the steam locomotive rather than the automobile. The railroads, which began with Robert Stephenson's tiny Stockton and Darlington line in 1825, had suddenly multiplied the number of visitors to London metropolitan area ten-thousandfold, and London's narrow streets simply could not handle the vastly increased traffic.

The newly-established Metropolitan Police force was untrained in traffic control and could do little to keep the traffic moving. However, the Victorians were not lacking in either ingenuity or the experimental itch, and a variety of new ideas were developed to get rid of the congestion in the streets. Semaphore signals, hand-bells, one-way streets, and footbridges over the busiest thoroughfares were all tried, as were dozens of other equally unsuccessful palliatives. There were simply too many people trying to move in streets that were too narrow and too few.

One of the first railways to come into London was Brunel's Great Western, which established its terminus at Paddington. In the year 1814, Paddington had been described as "a village situated on the Edgware Road about a mile from London." Twenty years later, the public was carried by steam power along the streets from Paddington to Moorgate, in the heart of the city – four miles away. Those early steam carriages were capable of conveying about a dozen passengers and did the journey in 35 minutes, with a consumption of coke averaging 10 to 12 lb per mile. But a surface street railroad could not relieve traffic congestion; rather, it helped to create further chaos.

The Battle for the Underground

Various claimants have vied for the honor of originating the scheme for handling passenger traffic by an "underground" railway, but the idea was more a product of the growth of London than the work of any single individual. However, the persistence of one man over an extended period of time actually kept the Metropolitan Railway scheme alive. This man was Charles Pearson, the solicitor to the Corporation of the City of London.

Originally Pearson had the idea of creating a Grand Central terminus at Farringdon Street for all the railroads wanting to come into London. He proposed "to carry the line of railway between two rows of houses, built so as to form a spacious and handsome street, 80 feet in width and 8506 feet in length. The railway to be on the basement level and to be arched over so as to support the pavement of the street which would be on the level of the ground-floor of the houses." Pearson proposed to give light and air to the railroad by openings or " blow holes" in the carriageway and footpaths.

Pearson was so farsighted that as early as 1833 he was lecturing before the Lord Mayor of London and the Common Council on the problems of traffic congestion that the coming of the railways would inevitably, in his opinion, cause. Just over 10 years later, he persuaded the government to appoint a Royal Commission to inquire into the possibility of dealing with the traffic which, by then, had grown to the proportions he had foreseen. The Commission began its sittings in 1845, and one of its first actions was to reject Pearson's scheme for a central station. Like many other Royal Com-

missions, this one continued to sit for a great length of time. And also like many others, it eventually produced a report which did not offer any solution at all to the problem it had been considering.

New Plan Approved

This gave Pearson another chance, and he came forward with an improved plan for a railway connecting the various main line terminals. This railway, he said, would for the greater part of the distance run beneath the surface of the roadway through a spacious archway. It was to be thoroughly lighted and ventilated.

An important feature of the railway was its proposed service to the Post Office. Sir Rowland Hill, the inventor of the "penny post" and then Postmaster General, wrote in regard to the project, "The Postmaster General thinks it necessary that such arrangements should be made as will admit of the intended railway being brought into the basement of the General Post Office building, so that the bags when made up may be placed at once in the railway carriages."

Pick and shovel work predominated underground. Excavated soil then was hoisted to the surface and loaded into small horse-drawn tipping carts.

The opposition was as loud as it was widespread, but despite this the North Metropolitan Railway ultimately was incorporated by Act of Parliament in 1853 and then reincorporated the following year as the Metropolitan Railway Company with an enlarged capital of $5 million.

A New Locomotive Needed

As the detailed plans for the railway were developed they underwent a number of changes. The idea of "blow holes" was scrapped and, instead, "smokeless" locomotives were to be used. Various ideas were tried out, the most ingenious, and later proved least efficient, being the hot-water and "hot-brick" locomotives, which had no fire – and therefore no smoke. Finally, Sir Daniel Gooch, the Great Western Railway's chief engineer, came up with a steam locomotive "emitting neither vapor nor smoke," and as the Great Western was to work the line, the Gooch locomotive was adopted. It was not perfect, but it had to do. Ventilation carried off much of the smoke from Gooch's "smokeless" engines.

Since the original intention was to work the Metropolitan Railway by "hot-water" locomotives, no special provisions were made for ventilation. It was admitted that the only ventilation along a considerable portion of the line would be by the stairways, and that the stations themselves would be dependent upon gas for illumination.

John Fowler, chief engineer of the company, proposed to use a locomotive using no fuel, but simply a reservoir of hot water capable of being heated up again at each end of the 15-minute journey. He planned to provide a reservoir of cold water to condense the steam. Isambard K. Brunel, of the Great Western, strongly supported the idea that the line could be worked with ordinary locomotives, without any artificial means of ventilation. "I thought the impression had been exploded long since that railway tunnels require much ventilation," he said. "Anyone who had driven a locomotive knew perfectly well that if you were going only four or five miles and had a good large boiler with plenty of steam and water, well heated up, you need not take a fire."

Expert Opinions Confounded

The evidence of the eminent experts was in perfect unanimity on three points. They believed that the hot-water locomotive was beyond all dispute the best way of working the line; that trains weighing 20 tons, inclusive of passengers but without locomotive, were the heaviest that could be use-

fully employed; and that the trip would take from 12 to 15 minutes.

Events proved that it was just on these three points that they were completely mistaken. The hot-water locomotive was never put into service; the trains necessary for accommodating the traffic weighed, exclusive of locomotive, about 120 tons instead of 20; and the journey time was doubled. Bearing these facts in mind, it hardly is surprising that further ventilation was required in some of the first portions of the line that had been constructed when they were worked with coal-burning locomotives weighing 45 tons and dragging 120-ton trains behind them.

Locomotive Design Trials

Design and construction of the first locomotive was entrusted to Stephenson & Company, then the best known locomotive builders in the world. It cost $22,500 and had a small fire-box and a large mass of fire-brick stowed away in a chamber in the barrel of the boiler. The idea was to convert the white-hot fire-brick into a reservoir of heat for use in the tunnels. On its trial runs, the results were less than satisfactory. Steam was got up to 120 pounds in three hours, the fire-bricks being at a clear white heat. After a run of 7½ miles, the locomotive was turned around. The pressure dropped from 120 pounds to 80 pounds in a few minutes and the coke-fire and bricks assumed an almost black appearance. Later, an improved locomotive was designed, but this too failed, and fortunately nothing more was done in the way of fire-brick locomotives.

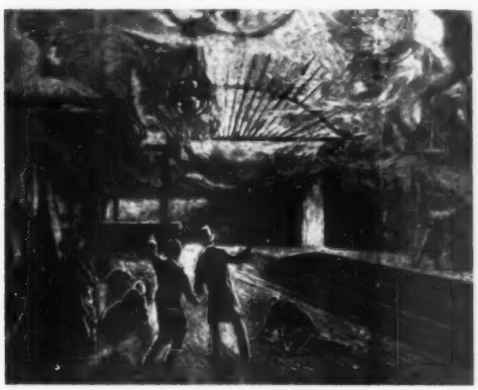
Meanwhile, construction work on the railway was progressing. When the first section was ready, it was decided to use an engine designed by Sir Daniel Gooch, of the Great Western Railway. On test this did the journey in 20 minutes, the locomotive weighing 38 tons and the train 36 tons. But the condensing water got hot, sulphurous fumes came out of the ash-pan and fire-box door, and a steam-jet had to be turned on to keep up steam. The six-wheel, broad gauge, tank engine, with four coupled wheels, 6 feet in diameter, definitely could not be called an unqualified success.

Resort to "Blow Holes"

Great Western Railway worked the line for some months, using the broad gauge. But its locomotives, and later those of the Great Northern, proved too light for the work and a specially designed engine was finally produced. It was quickly discovered that the inconvenience from the discharge of carbonic acid and carbonic oxide gases was great. Alarmist paragraphs headed "Choke-damp on the Underground Railway" appeared in the daily newspapers, and a small fan and motor were arranged to blow air into the Portland Road Station to allay the public's fears. Owing to increased traffic and the use of coal instead of coke, there was another outcry a few years later. Ventilation was further improved by opening portions of the covered way at four of the stations. Finally, in 1871-2, the infamous "blow-holes" were made in the pavements of the streets covering the tracks. Both humans and horses were instantly panicked when a train "blew" through one of these vent holes.

Inadequate ventilation on the initial length of the line resulted in subsequent extensions of the Metropolian Railway, and of the District Railway which came soon after, being arranged wherever possible with the stations in the open. A section of cutting was located at each end, and an intermediate cutting was located between the stations.

The work on the "cut and cover" tunnels began in January 1860, and the difficulties of construction – pick, shovel, and wheelbarrow being the only tools used – were enormous. London's underground rivers and streams, some of which already had been



Two explosions beset the subway in its early days, bringing on an examination by government officials.

converted into sewers, were but one of the hazards that had to be overcome.

Geography Creates Problems

The two leading features of a city railroad, as of any other, are the route followed and the level at which the track is laid. As a rule, the route is determined by the desire to secure certain definite types of traffic, while the levels are controlled by the physical configuration of the ground, the lines of drainage, and similar obstacles.

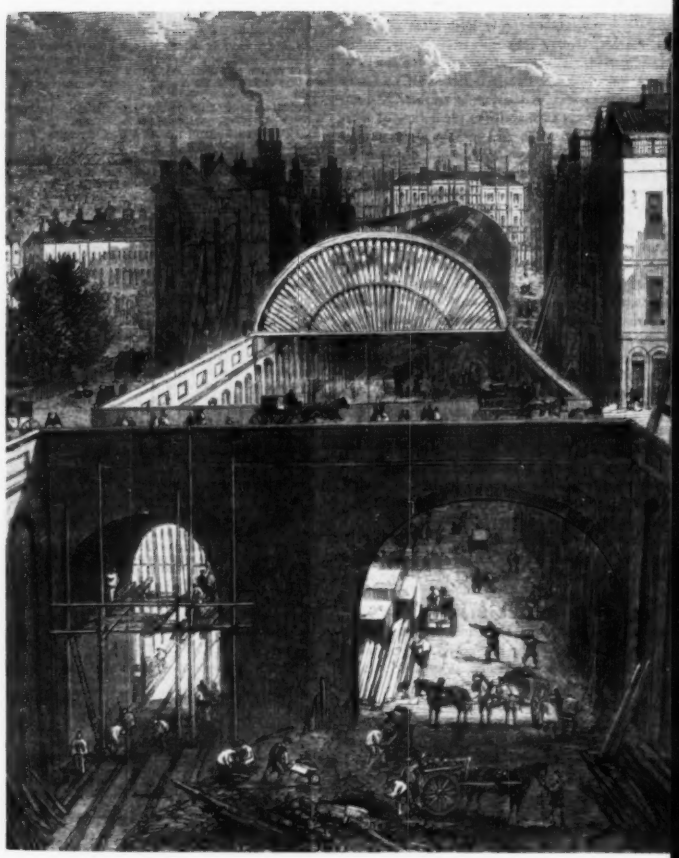
London's Metropolitan offered no exception. When a tract of country is closely covered by buildings of varying heights and the natural watercourses have been converted into covered sewers, it is difficult to form a general idea of the physical features determining the character of the railroad as regards level and gradients. Fortunately for the engineers designing the subway, the history and geography of London was fairly well known, even if parts of the story were more legend than fact.

It was known, for example, that the River Thames had coursed through the area much more widely than it was at the time of construction, and that the planned course of the Metropolitan would cross at least three major tributaries – the West Bourne, the Tybourne, and the Fleet Rivers – in addition to more modest streams. Though a benefit to the northern outskirts of London in olden times, the Fleet presented a major problem to the Metropolitan's engineers. It had been converted into a huge sewer, and the route that had been plotted would cross and recross it no less than five times.

The hazards were great, and the fears of the designers were fully realized. On numerous occasions the sewer's walls were breached but quickly dealt with. But on one more serious occasion, close to Farringdon Street Station where the Fleet was carried in a slightly built brick channel 10-ft in diameter and resting on rubbish filled into the bed of the old river, the wall toppled over. Work was hampered considerably when the workings were filled with a flood of sewage for a great distance.

Planned Route Difficult

The planned route for the Metropolitan Inner Circle Railway was not an easy one. The whole of the southern section of the line traverses the old bed of the Thames and its surrounding swamps. As a matter of fact, the average level of the line in this section is 13-ft below the present high water mark, while the northern section is 60 feet above the high water mark. Since the ground dipped from north to south at a far steeper gradient than would be admissible on any railroad, deep cuttings had to be made to ease the gradients. Thus, at Campden Hill, cuttings 52-ft deep and a tunnel 1263-ft long were required in the west, and cuttings 33-ft deep and a tunnel 2184-ft long in the east.



Contemporary sketch shows the construction work at the Aldersgate Street Station of the Metropolitan Railway.

The respective gradients for getting down the sloping ground were about ¾ mile of 1 in 70 in the west, and a mile of 1 in 100 in the east. The curves on the line, which were of course determined by the sources of traffic and by property considerations, have a minimum radius of 660 feet.

The route of the line offered the planners a wide variety of soils to deal with. A considerable amount of made ground was necessarily looked for at the east end of the southern section, as the line was to be carried through a city founded more than 2000 years before – and ravaged and burnt by Celts, Romans, Saxons, Danes, and Normans in turn. In places, as much as 24 feet of ruins and dust were cut through. At the mouth of the Fleet, which was once a wide estuary, the chalk rubble foundations of an old fort were exposed.

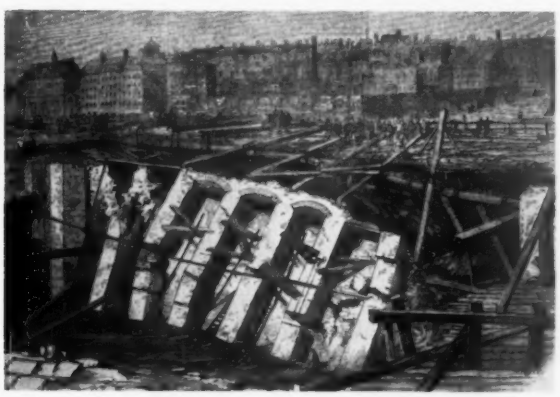
Further to the west, it was naturally expected that the old bed of the river, with its mud and silt, would constitute the chief part of the excavation. At Charing Cross, the walls of the covered way had

to be carried to a depth of 25 feet below rail level – or 37 feet below high water – to secure a solid foundation. Similarly, at the Temple, they had to go down 21 feet and at Blackfriars (at the mouth of the Fleet) 13 feet.

Further west, in what was known to have been swampy ground and flooded at every tide, peaty deposits were expected – and found. In several places, layers of peat up to 700 feet in length and varying from 2-ft to 7-ft thick, were found at from 9 to 24 feet below the surface. A few feet below this peat, clay was found and a number of stations – and the tracks between – rest on the clay. Over the clay were varying depths of gravel and sand, heavily charged with water.

The gravels and sands met during the excavation probably were deposited at periods separated by many thousands of years, and reports of the discovery of the remains of elephants and rhinoceros belonging to different parts of the Pleistocene epoch were received. In making the excavations, the gravel generally was found to be fairly dry to about the depth of the inverts of the adjoining sewers, but below that level large volumes of water had to be dealt with. Before commencing the cuttings, sumps were sunk and lined with timbering or wrought iron cylinders, 10-ft in diameter, and chain pumps lifted the water into the nearest sewer.

Dealing with the old streams (other than the Fleet) which had been converted into sewers was comparatively simple. The West Bourne was carried under the line on the northern part of the Inner Circle but was well above track level at Sloane Square, at the western end of the southern section. To deal with the sewer at Sloane Square, it was encased in a cast iron tube, 9 feet in diameter, supported on wrought iron girders of 70-ft span and carried over the track well above train level. Just how well that sewer bridge was built can be gauged from the fact that, when Sloane Square Station was practically razed by a bomb during the Blitz in World War II, the sewer remained intact.



Bursting of the Fleet River sewer near the Farringdon Street Station was one of the project's major accidents.

At Baker Street (on the northern part of the Circle) the Tybourne crosses the track in an oval tube resting on cast iron girders, while at Victoria, the next station east from Sloane Square, it again crosses the line, but this time in a tube 14 by 11 feet – twice the dimensions of those needed at the northern crossing.

So close to the surface do these two sewers run that it will be understandable that any major engineering work in their neighborhood involves vast expense. For example, to build a new street underpass at Hyde Park Corner (half a mile north of Victoria) already has involved nearly two years of work. Hundreds of thousands of dollars have been spent to realign the Kings Scholar Pond sewer, as the Tybourne is now called, and the work still is not finished.

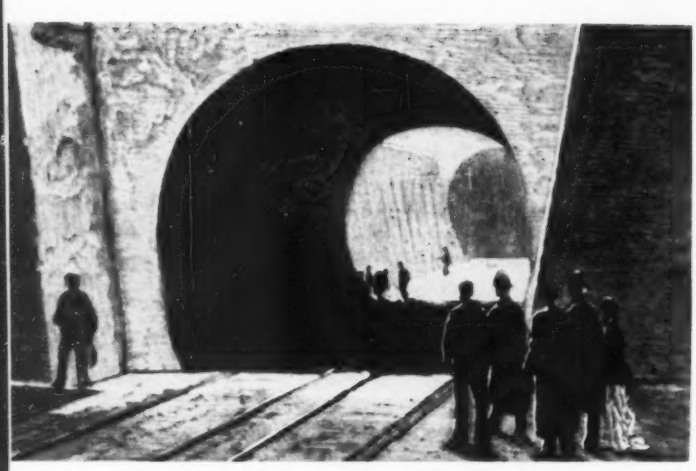
"Underground" Equals Subway

In the early days of its life, the Metropolitan Railway was familiarly spoken of as the "Underground Railway," to distinguish it from the numerous other projected urban lines, which were to be surface or elevated railroads. This name has stuck to all the subways built in London ever since. On the Inner Circle, the depth of rails below the surface of the ground ranges from 9 to 65 feet, and as the cost of property precluded the use of ordinary open cuttings with slopes, the works necessarily consisted of covered ways, tunnels, and open cuttings with retaining walls.

When the Metropolitan Railway was first planned, under agreements with the Great Western and the Great Northern Railways, the line from Paddington to Moorgate had to be laid with mixed gauge tracks – since the Great Western was then still using broad gauge, while the Great Northern, in common with all other railways, was using standard (4'8½") gauge. The original covered way for this section of the line, therefore had to be 28½-ft wide, compared to 25 feet on later extensions.

Covered Way Construction

In this section, the covered way consisted of a six-ring elliptical arch of 28½-ft span and 11-ft rise, with side walls three bricks thick and 5½-ft high from the rails to the springing. No invert was constructed, nor was there any concrete under the 4-ft wide footings. After the line had been worked for a short while it was discovered that a short length of the side walls had slid forward, owing to the heavy locomotives then used, working up the clay formation and withdrawing the support from the toe of



The section between Praed Street and Edgware Road Stations in an early print of the London Underground.

the wall. This fault was remedied in later sections, and a concrete foundation, 5-ft wide and 2½-ft thick, was placed under the side walls.

Along the southern section, where the track followed the line of the Thames Embankment, a brick invert with concrete underneath was introduced, and on certain low-lying parts there was a concrete invert. Where a junction of main line and Metropolitan occurred in a covered way a "bellmouth" was constructed. At Paddington, the "bellmouth" consisted of the usual brick side walls, with an elliptical wrought iron arch top. The ironwork resembled the inverted hull of a large iron ship. At King's Cross, the depth of ground permitted the adoption of a brick arched top. Manholes or refuges were placed 50 feet apart on alternate sides of the track, and an 18-in. barrel drain was carried along the 6-ft way. Ordinary stock bricks were used throughout the construction.

The method of constructing the covered ways varied at different times and under different contractors. On the original section, from Paddington to Euston Square, the excavations were carried to the full width of 33½ feet and timbered across. At one point there were heavy buildings on each side, and the road traffic had to be maintained overhead during the construction of the covered way. Balks of timber 16-in. square and 43-ft long, spaced 5 feet apart from center to center, were first laid across the site of the proposed cutting and planked for the temporary roadway, with one longitudinal and one transverse row of 6″ x 12″ timbers. As the trench for the line was cut beneath this, wooden walling was put in until the base level was reached. Next the permanent brick side walls were built to a height of 4 feet, iron centers were installed 6 feet apart, and then finally the arch was turned.

In later sections, the general practice was not to excavate the full width of the cut, but to dig two side trenches, each 6-ft wide. The side walls were built up and the arch turned before the central area was excavated.

There were three tunnels to be built, one 2184, one 2199, and one 1263-ft long. On the shortest tunnel, a labor strike compelled the contractors to dig it on the cut-and-cover principle. However, the results were not satisfactory, and a general settlement of adjoining property occurred.

Papering the Cracks With Bank Notes

Difficult as the geography of the land was, the new lines most ferocious enemies were the litigants who appeared in swarms as construction progressed. Every time a crack appeared in a house anywhere near the line of the railway, the directors of the company were served with a writ for damages. The claims for compensation were so terrific and unending that Sir Edward Watkin, chairman of the company, dwelt bitterly on "papering with banknotes the allegedly cracked walls of a chapel."

The vastly differing soils along the line of the railroad led to many differing lists of complaints from property owners nearby – many of them obviously exaggerated. In one 160-ft length, a tunnel was driven within 10 feet of a heavy prison wall with hardly any sign of settlement, and in many other places similar success was achieved. But, as Sir Benjamin Baker, who was chief engineer for 11¼ miles of the 13-mile Inner Circle, pointed out in 1885, "With the utmost precautions, tunneling through a town is a risky operation, and settlements may occur years after the completion of the works. Water mains may be broken in the streets and in the houses, stone staircases fall down, and other unpleasant symptoms of small earthquakes alarm the unsuspecting occupants."

There are 27 stations on the 13 miles of the Inner Circle. It was the original intention to make the stations, as well as the railroad, strictly "underground," and three stations were so constructed. But it was found that it was costing $90,000 more to put a whole station 300-ft long below street level than to construct a similar length of covered way. Later stations were built at surface level, with stairway connections to the platforms. The cost of these ranged from $70,000 to $110,000.

Soon after the railway was opened large numbers of buildings were erected over it at different points. In some cases the covered way was originally constructed of sufficient strength to carry buildings, but in others it had to be strengthened. Where the depth of the railway was sufficient for an arch, brick-covered ways were used in preference to iron girder constructions, on account of lower cost and in-

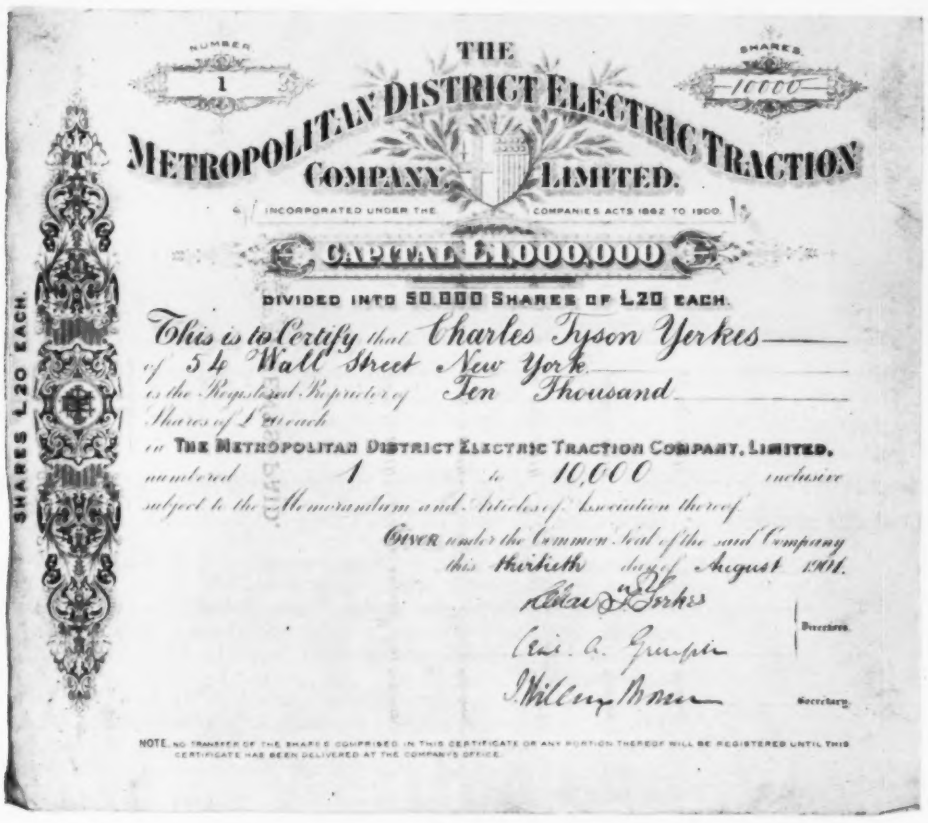
creased durability. At two stations, Westminster and Blackfriars, buildings some 80 feet in height were erected on girders spanning the tracks and platforms. Nearly 100 years later, one of these still stands, as does a part of the other which was damaged by the bombing of World War II.

Million Dollar Miles

Because of the many complicated conditions in the contracts and the varying financial liabilities assumed by the contractors, it is practically impossible to give an accurate figure for the cost of building the Metropolitan Railway. Sir Benjamin Baker estimated that the Paddington to Farringdon Street section cost about $930,000 per mile, while a later section ran to over $1 million a mile.

The experts who had decried the whole plan had to wait until January 1863 to discover how wrong they had been. The rush of would-be passengers on the opening days was so great that the station gates had to be closed. Within two months of the opening, Sir John Fowler, Sir Benjamin Baker's partner and late co-designer with him of the famous Forth Bridge, reported to the Prime Minister that the number of passengers per mile on the Metropolitan was 2,792,000. This was nearly four times as many as on any other line and practically 400 times more than the figure for the Great Western Railway. The receipts per mile per week were $3147. This result seemed too good to be true and many people said it was merely "curiosity traffic." But, by 1867, when the first extension was opened, there must have been a terrific amount of curiosity left in Londoners and visitors to the English capital, for the receipts per mile per week had steadily gone up, from $3415 at the end of 1863, to $3925 in 1864, to $4550 in 1865, and to $5395 in 1866. The report for 1884 showed that the total number of passengers carried on the "Underground" was about 114,500,000 and the receipts were just over $5 million.

As soon as the success of the Metropolitan Railway was established, work was begun on the District Railway. Because of some overlap, intense rivalry and considerable squabbling existed between the two for a number of years. But, by 1901, a merger was arranged and the two railroads became the Metropolitan District Electric Traction Company Limited, with a capital of $5 million. It is a matter of record that the first stock certificate issued, for shares Nos. 1 to 10,000 (at $100 each) went to Charles Tyson Yerkes of New York City, a director of the new company. ▲▲


NUMBER
1
SHARES
10000
THE
METROPOLITAN DISTRICT ELECTRIC TRACTION
COMPANY LIMITED.
INCORPORATED UNDER THE COMPANIES ACTS 1862 TO 1900.
CAPITAL £1,000,000
DIVIDED INTO 50,000 SHARES OF £20 EACH.
SHARES £20 EACH.
This is to Certify that Charles Tyson Yerkes
of 54 Wall Street New York
is the Registered Proprietor of Ten Thousand
Shares of £20 each
in THE METROPOLITAN DISTRICT ELECTRIC TRACTION COMPANY, LIMITED,
numbered 1 to 10,000 inclusive
subject to the Memorandum and Articles of Association thereof.
Given under the Common Seal of the said Company
this thirtieth day of August 1901.
Directors.
Secretary.
NOTE. NO TRANSFER OF THE SHARES COMPRISED IN THIS CERTIFICATE OR ANY PORTION THEREOF WILL BE REGISTERED UNTIL THIS CERTIFICATE HAS BEEN DELIVERED AT THE COMPANY'S OFFICE.

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Eight Westinghouse DT-3 Transformers serve 10 acres of office and manufacturing area quietly... quietly... quietly
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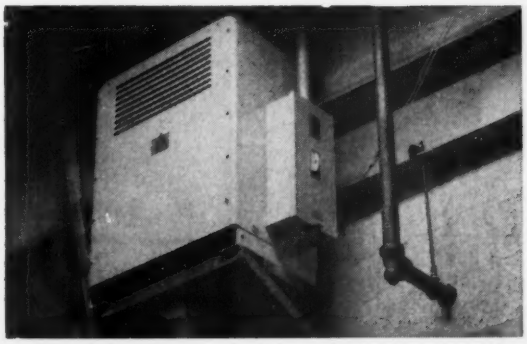
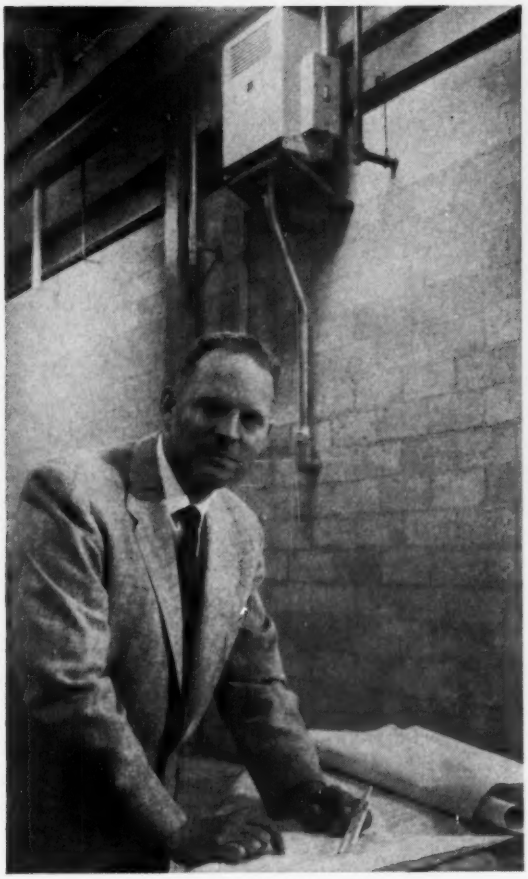
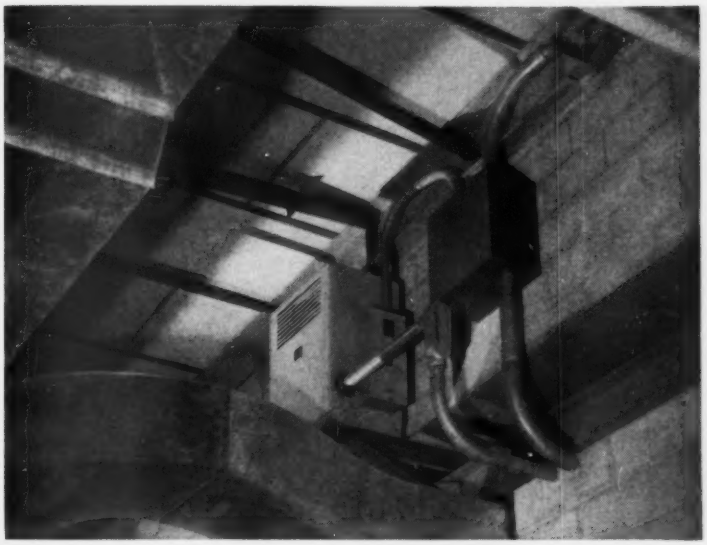
Westinghouse dry-type transformers operate at 45 decibels or below . . . 10 to 15 db's below NEMA standards. The core-coil assembly floats on a mechanical vibration damping system, independent of case, base or conduit. This unique feature accounts for the lowest sound levels ever found in dry-type transformers.

Mr. Walter Jones, plant maintenance engineer for F. N. Burt Company, says: "The Westinghouse DT-3 transformers are the quietest units I've ever worked with. We employ about 900 persons—700 of them women. They're



"In some cases," comments Mr. Dean of Buffalo Electric Co., "transformers were installed in areas congested with large air conditioning ductwork and steam piping, at times as close as 24 in. from plant ceiling. The DT-3 transformers are compact enough to fit into these tight quarters, light enough to lift into place without special hoist equipment. Easy to wire, too—terminals are located on the bottom in cool air—giving longer life and less maintenance to cables."





"These transformers serve our entire plant—office, kitchen, manufacturing area, powerhouse. With 10 acres of floor space under roof, we have plenty of maintenance to handle—we really appreciate the maintenance-free design of Westinghouse DT-3 transformers," states Mr. Jones. "All we have to do with these new units is wipe them down with a damp cloth once every six months."

particularly sensitive to noise—a constant humming irritates them. Production drops as nervous tensions increase; hence, we chose Westinghouse quiet transformers."

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LEE'S LECTURE

Science, the Classics, and Survival

JOHN F. LEE
Broughton Professor and Head
Department of Mechanical Engineering
North Carolina State College

THE SUMMIT has been displaced by the presidential campaign and still stands the question, more insistent than ever, of survival in this confused age. The desire for survival brings the obvious urge to redouble our efforts in science and technology. Unfortunately, the redoubling of effort is directly translated into redoubling of appropriations for defense, including scientific research and development. This translation is unfortunate in that the results obtained will fall far short of expectations because more is involved than a simple correlation of dollars and technological progress. If we are to survive, it is essential to examine more introspectively what is truly needed for survival and the mode of survival we seek to achieve. There is no avoiding the fact that mistakes and neglects of the past cannot be lightly brushed aside. They remain to haunt us and impede the speed of progress toward sure survival.

The American heritage has its roots in a western culture in which Genesis and Homer are dominant — a culture which delights in the harmony of philosophy, art, and life in the periods of the Sungs, Pericles, or Louis XIV. This culture developed for 2500 years before being shocked by Newton, Darwin, and Copernicus. Western culture has never quite accepted science. Rather, it has viewed it almost with distrust. There is ample evidence in our literature of this distrust of science, and the inimicable reaction to new scientific thought is well documented historically. Science has never been accepted as an integral and respected part of our entire culture.

Science New to Education

American education was born in theology and the classics. Only slowly and with reluctance was science allowed to move into our universities and schools. Only in recent times did science achieve a respectable role in American education. But let there be no belittling of the fact that this classical or philosophical heritage brought forth the principle of a government ruled by a free people. However, a public uneducated in the meaning of science in our culture constitutes a danger for the survival of the very culture we are dedicated to preserve. It is not a question of classical *or* scientific education but the vital need for classical *and* scientific education as integral components.

When we observe the frighteningly rapid progress through science and technology for such formerly backward nations as Russia we become deeply impressed with the power of science. It is a modern paradox that many voices should be raised in favor of strengthening and expanding scientific education at the expense of classical education. The paradox is that a public steeped in the strong moral and philosophical heritage upon which our concepts of freedom rest should so willingly accept the sacrifice of classical education as a mistaken price for scientific advancement. If this is indeed the price for survival then perhaps the world in which the survivors will live may not be too different from that behind the iron curtain today. One can well ponder on whether we want survival in that sense.

Classical Education Inadequate

Of course it would be foolish to maintain that the classical education received by most of the western leadership is adequate for modern needs. Very often more

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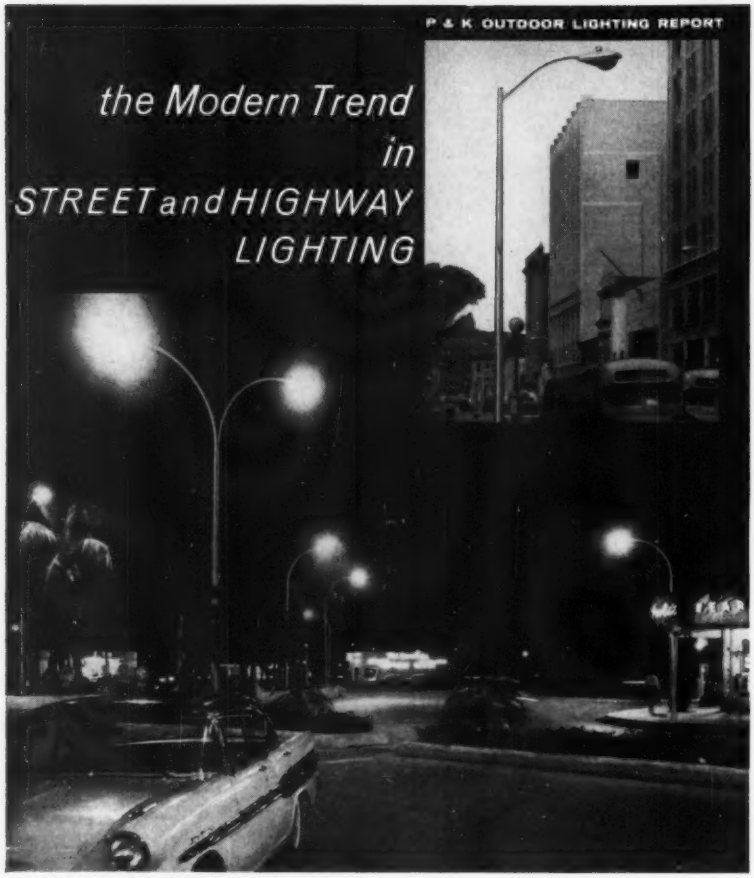

TOP PHOTO: New White Way—White Plains, New York
LOWER PHOTO: Traffic circle illumination— West Miami Springs, Florida

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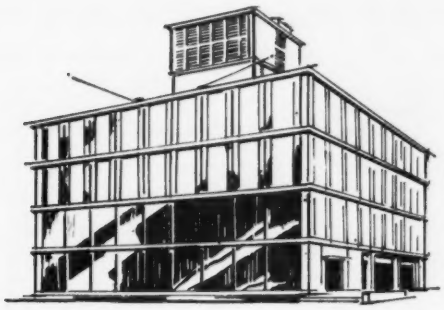
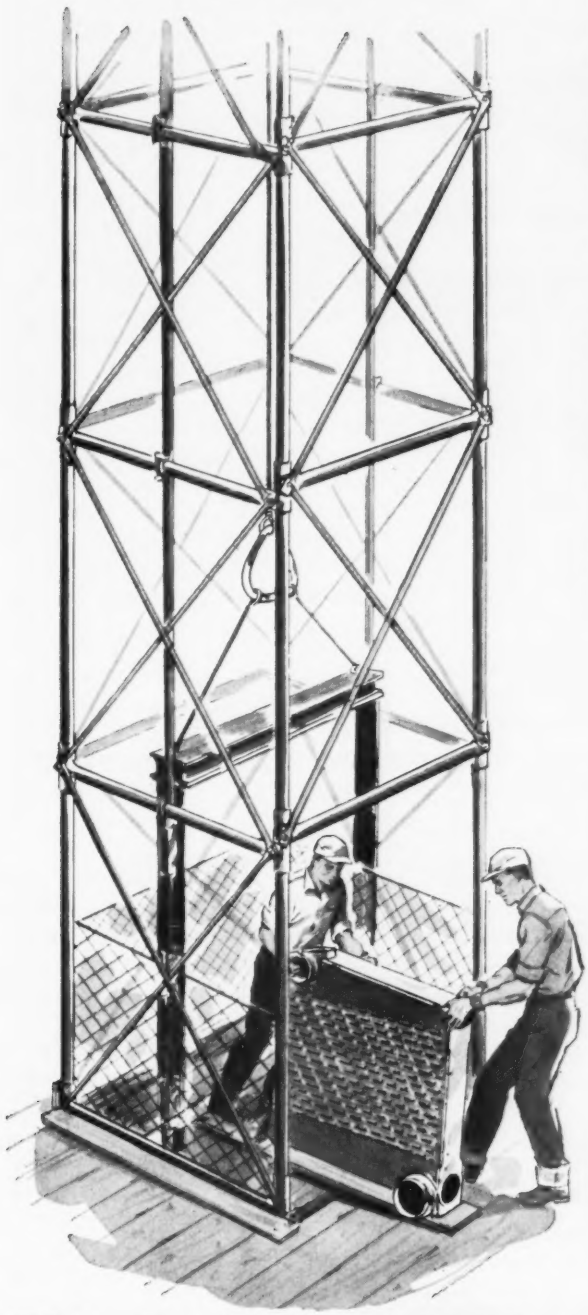
emphasis was placed on the well-turned phrase or the social advantages of being conversant with classical writers and philosophers. The mere acquisition of polish will not prepare leaders to cope with the unusual and pressing problems of this age. Such an education often leads to a certain naivete that can be more devastating than the effects of hydrogen bombs. Classical education, which provides only a cultural gloss without an ability to interpret the meaning of philosophy in drastically new circumstances, cannot provide a basis for survival. On the other hand, one can safely say that a man whose education leaves him ignorant of the meaning of science in our culture today is indeed an ignorant man. He is no less ignorant however, than the scientist who has no feeling for or understanding of western thought except for a few well remembered catch phrases. Both men are dangerous to our survival as a free people.

Some time ago we recognized that classical education was producing many educated fools incapable of contributing seriously to modern civilization. This recognition brought about the upheaval leading to curricula which produced well adjusted people trained to enjoy life and ignore its real problems. The appearance of Sputnik shattered this dream world and fostered a return to "old-fashioned" education or wholesale recruitment into science. Either course is wrong, and we have not yet faced up to the educational needs of a people who not only wish to be safe but also free. It is certain that to adopt the Russian system of education will not keep us free and it may not keep us safe either. But if our understanding of democracy is limited to what can be read in history and civics books or the acceptance of catch phrases, it is certain we shall neither be safe nor free. To truly understand and believe in freedom our education must emphasize the critical under-



HOW TO INSTALL A BOILER IN A PENTHOUSE... *WITHOUT A DERRICK!*



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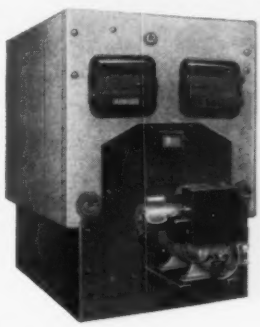

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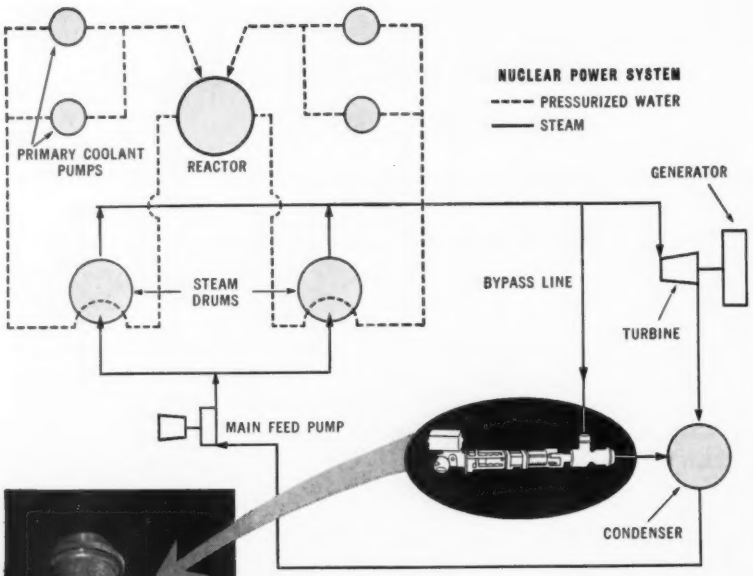

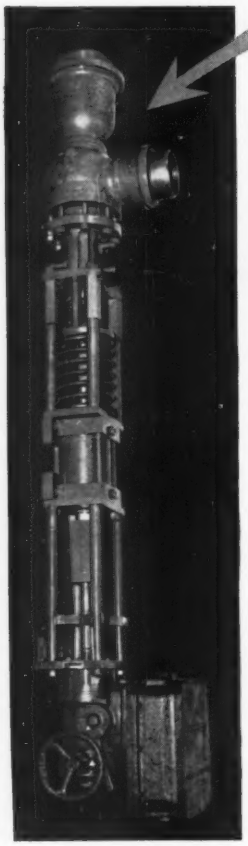

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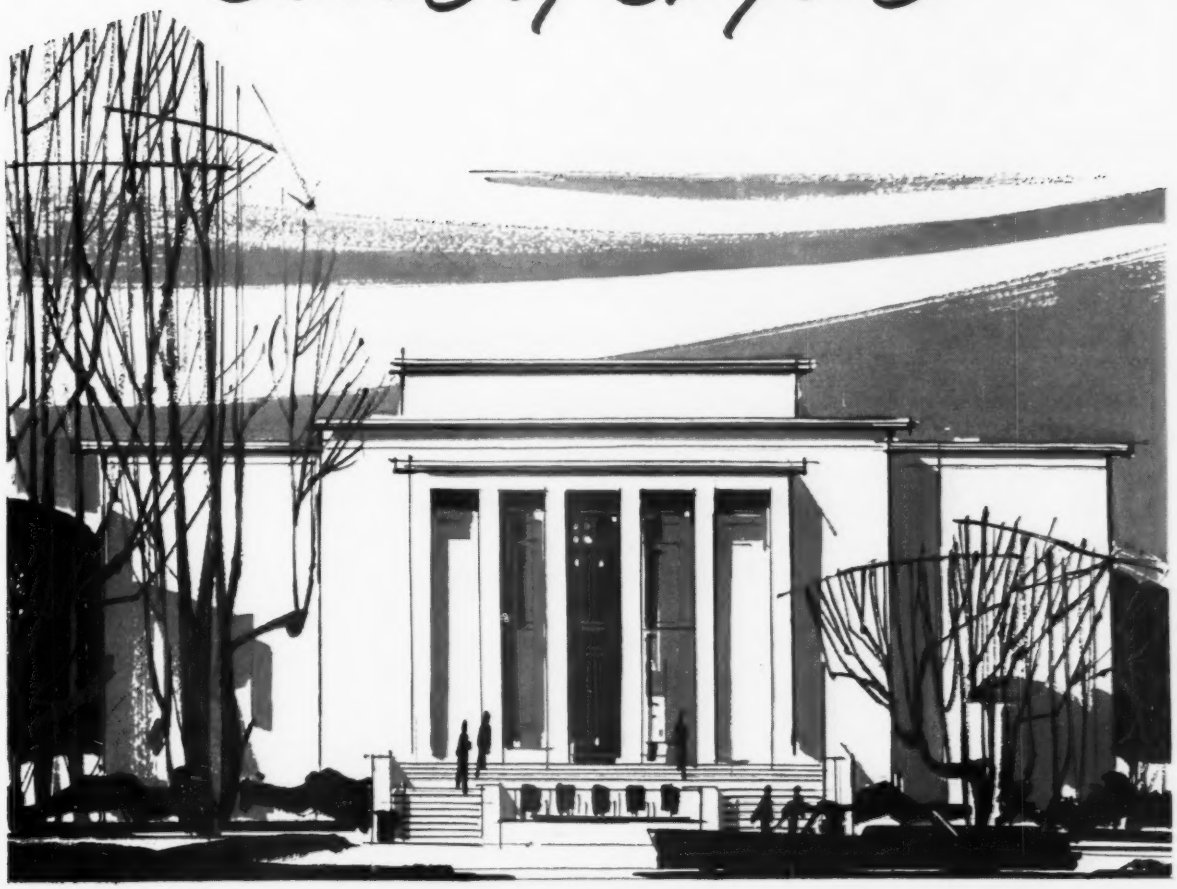
standing of our cultural and philosophical heritage including science as an integral component.

Conduct Reflects Education

To appreciate what is meant here it is only necessary to examine a few recent occurrences. The behavior of American prisoners of war in the hands of the enemy during the Korean conflict rudely shocked Americans. The whole story has never been widely publicized, but the U.S. Defense Department has thorough documentation of the frightening experience. These prisoners fought gallantly in the field but were woefully unprepared for the ideological battles waged in the prison compounds. Their thin armour of catch phrases – main street, apple pie, the history book description of Washington at Valley Forge, and the ability to recite the Declaration of Independence – was quickly pierced, in too many cases, by the incisive and sophisticated arguments of their captors. After the armor was pierced, it was easy to show these prisoners that after all they knew very little about the ideas they believed in. Indoctrination courses in the U.S. Armed Forces and the so-called preparation for citizenship they received in school were no defenses for these Americans. One can only ponder what the effect on the captors might have been had our soldier-prisoners been able to win the ideological struggle.

Another recent example is the U-2 incident – which must have been a rude shock to the Russian leaders, believing as they do in the invincibility of science and technology as protective armor. However, the incident raised many questions for Americans. Why did Frank Powers choose to live rather than destroy himself and his plane and thus protect his country? Why were the American people shocked that our government would countenance a pact with an individual to destroy himself? And why were we

Climate by Chrysler



South Carolina Archives Building, Columbia, S. C. **Architect:** G. Thomas Harmon, and Assoc.; **Consulting Engineer:** Watson Engineering Co.; **General Contractor:** Atlantic Building Co.; **Air Conditioning Contractor:** Columbia Heating and Cooling Co.

Chrysler Air Conditioning controls humidity within 2% to preserve treasured archives

Some old, some new—but of South Carolina's historical records and documents available you'll find many of them in the state's new Archives Building. All are preserved for future generations in climate created by Chrysler.

The air conditioning divides into two separate air systems: a high-pressure system for comfort cooling—a low-pressure system for humidity control in storage areas. A 60-ton Chrysler Radial Chiller cools with a flexibility that allows an accurate 50% relative humidity so necessary in eliminating the deterioration and brittleness which age brings to paper. Control is so precise, humidity never varies more than 2%.

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Economy is reason enough for choosing Chrysler Air Conditioning, but only one of many advantages. Another is the cooperation given consulting engineers and contractors by Chrysler engineers. For the whole story, for information on Chrysler equipment and engineering assistance, write today.

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KRALOY PVC RIGID CONDUIT before encasement in concrete slab. Its mirror-smooth interior walls make fishing easier.

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NOTE THESE WEIGHT COMPARISONS (LBS.)

Trade Size	½"	1"	2"	3"	4"	5"	6"
KRALOY PVC	**15.0**	**29.0**	**63.0**	**131.0**	**187.0**	**253.0**	**326.0**
ALUMINUM	27.4	53.0	115.7	238.9	340.0	465.4	612.9
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NO CONDUIT REPLACES **KRALOY**

KRALOY PVC CONDUIT is sold only through wholesale electrical supply houses.

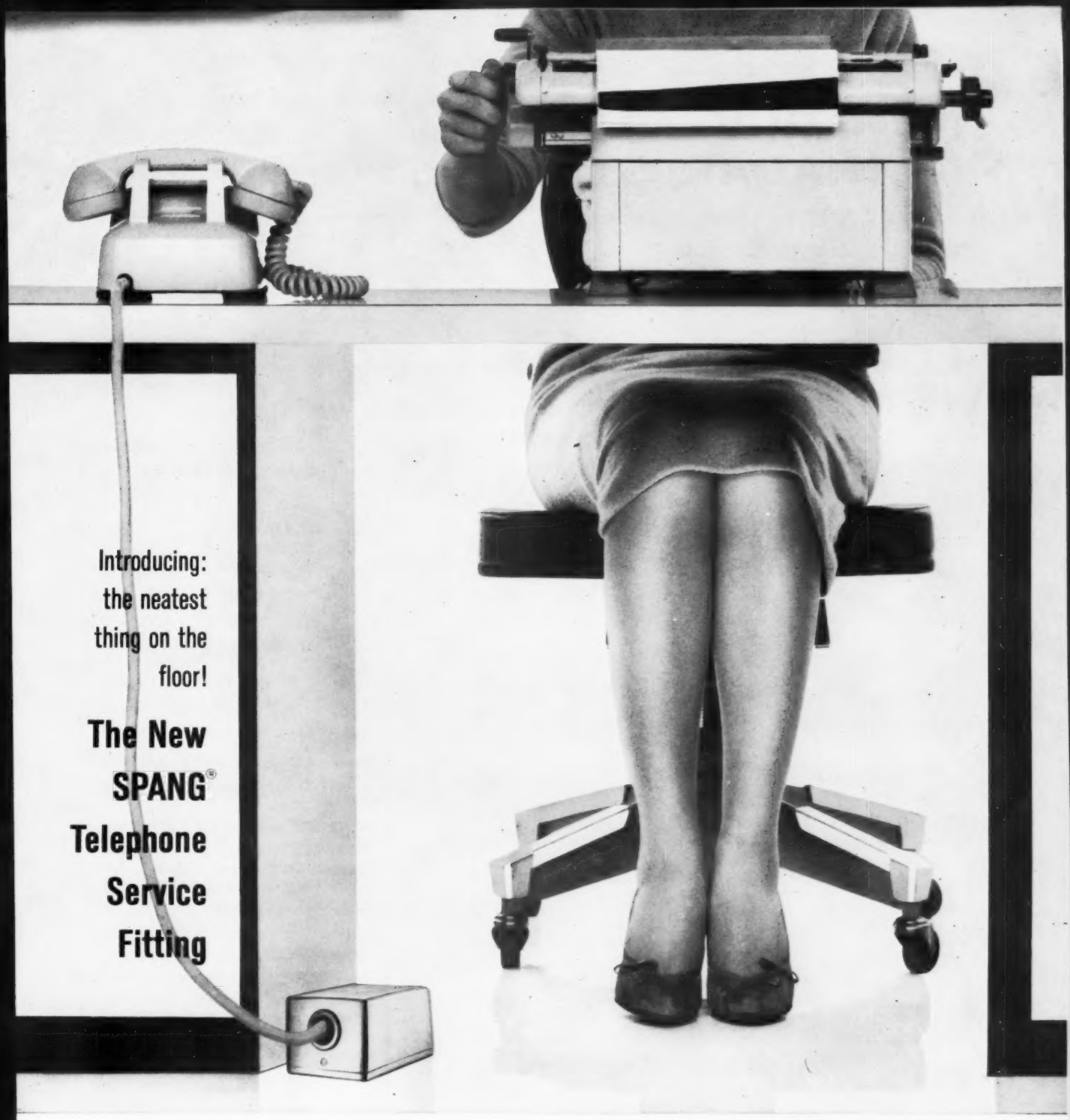
*For direct underground burial or encased in concrete.

shocked to learn that our government engaged in spying and is capable of lying about it? Is our understanding of our heritage so shallow and is our naivete so great that the fable of George Washington and the cherry tree should be a dominant feature of the meaning of American democracy? All of these incidents and reactions show clearly the need for an overhaul of our educational system in more than the area of science.

Science Not Understood

No less dangerous is the lack of understanding of science prevalent in our society. There are several features of this situation which require examination. Most of our present scientific leadership was educated out of context with the whole experience which produces educated men. When called upon to exert leadership beyond the scope of science they have failed too many times to inspire public confidence. Yet the consequences of their work are determined by men who often have little or no understanding of science. Because of the absence of science in so-called liberal education there is too ready an adulation accorded science. Often this adulation is offered in an aura of awe, borne of ignorance. The inability to place science in its proper role in our culture is due principally to the fact that science has not in the past been recognized as an integral part of our culture. Neither the scientist nor the nonscientist is now capable of putting the pieces together in a framework that has meaning in this age. That this situation is dangerous for our survival can be seen in many specific examples.

Since the invention of the atomic bomb, and more recently the appearance of space satellites, there has been a feverish support of science through large expenditures of money. Scientific research used to mean the search for pure knowledge. It was not concerned with



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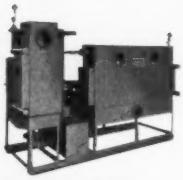

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applications. When financial support is inspired by the applications of science, and the public is unaware of the fact that application is not a function of science, it is not surprising to find that scientists become application conscious. Yet within the hierarchy of science more prestige is given to those who disdain application as a prime motivation. Now the application of science has been principally the function of a segment of our society composed of engineers, production managers, and marketing specialists. While science, in the public mind, receives credit for weaving the whole cloth – and disdains the practical application – it is not surprising to find that everyone wants to be a scientist and few wish to create something useful. If this present trend continues, we all shall be in a great deal of trouble – scientists included. However, we are probably better off with the scientists than with engineers and other specialists, who are ignorant of science.

The Way to Survival

To survive as a free people, we must halt the swinging of the pendulum from one extreme to another. We must return to a system of education soundly rooted in our cultural heritage but including science as an integral part. We must then encourage people to follow pursuits in which their talents and natural interests are the governing factors for the choice. We must cease to shift people from one educational pursuit to another simply to meet what is mistakenly thought to be the most pressing need of the moment. Unless a citizenry has a broad education in all facets of our culture it is not likely to be wise in determining what constitutes the most pressing need. Such a broad education at the primary and secondary school level is far more practical, in an age when survival is in question, than the development of skill in driving automobiles or baking cakes. ▲▲

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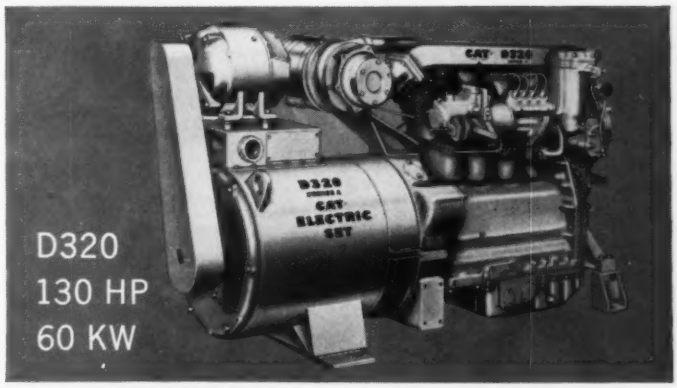
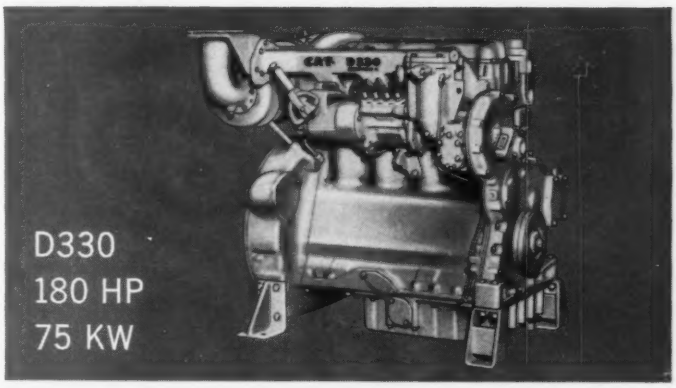
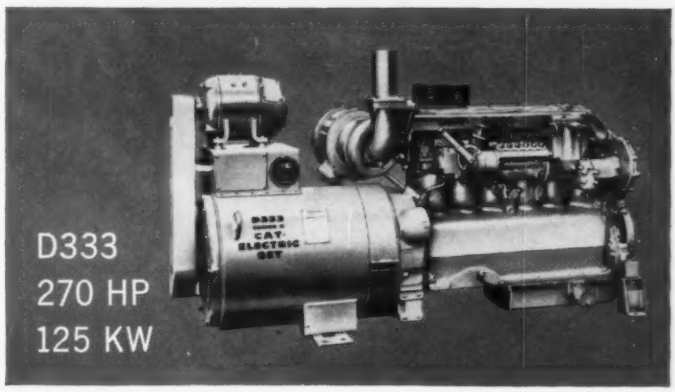
For complete performance specifications on these new Caterpillar Diesels or on the complete line, see your Caterpillar Dealer. Or, write to Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A. Ask for the catalog on the complete Caterpillar Engine line.







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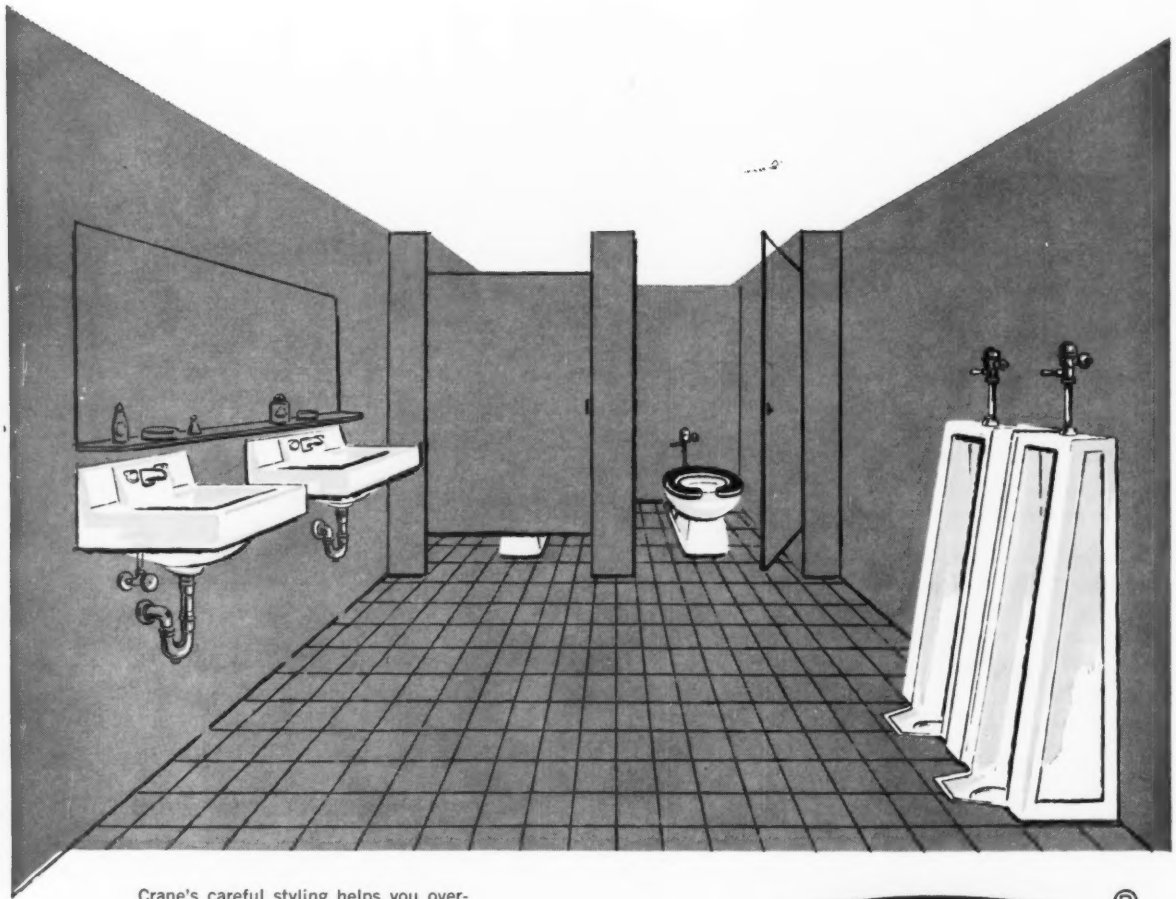

Crane's careful styling helps you overcome the cold, austere atmosphere of many washrooms. Simple lines help expedite cleaning and care, too.

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design it into your commercial buildings at no added cost...with Crane plumbing

Some of your commercial clients know how to judge design and specification quality. Others have no basis for comparison. Both kinds of client rely on the brands you specify to indicate the level of quality.

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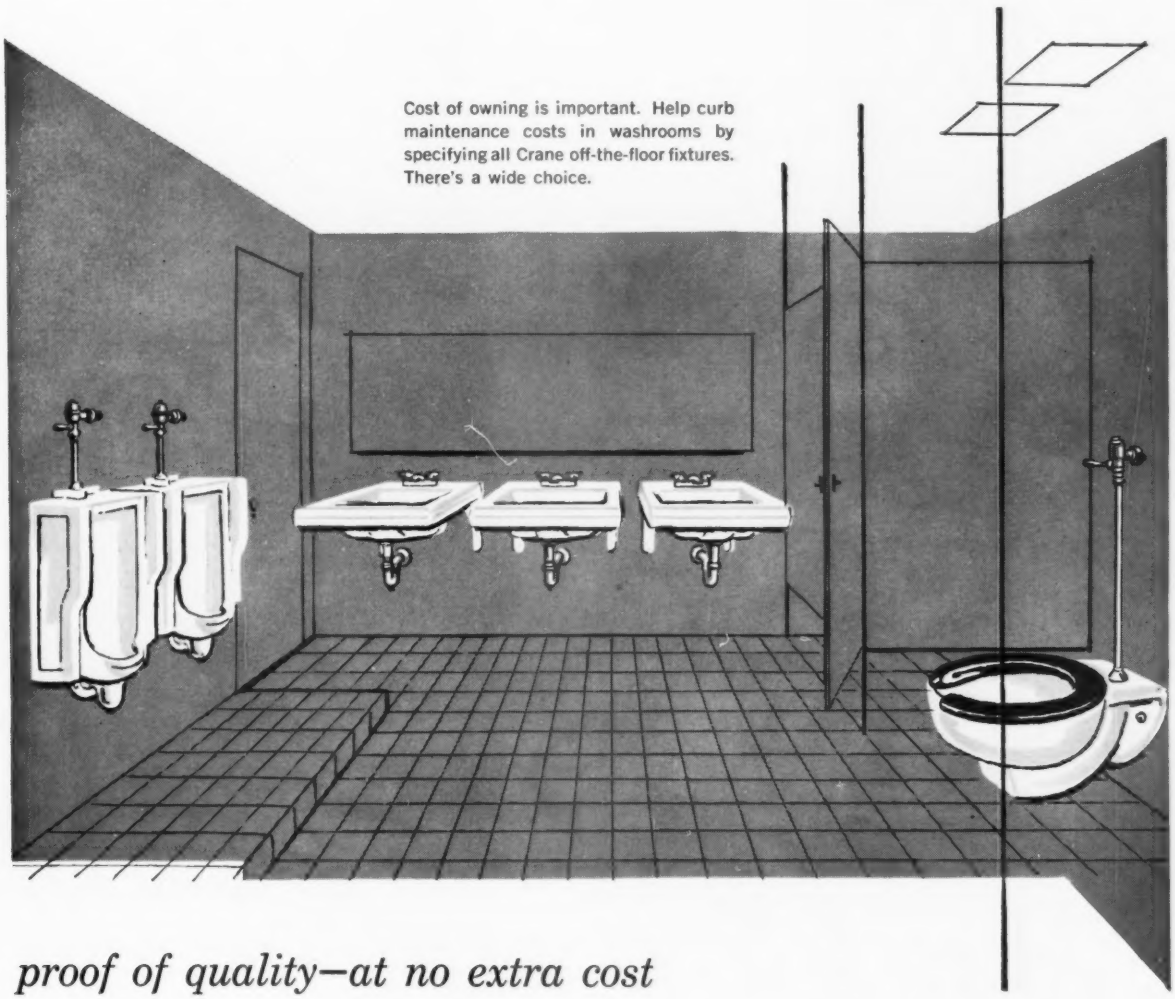
Design *proof of quality* in your next commercial building. Ask your Crane representative or plumbing contractor for help whenever you need it. Either one will gladly help you achieve the installation you want.



Cost of owning is important. Help curb maintenance costs in washrooms by specifying all Crane off-the-floor fixtures. There's a wide choice.

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To eliminate forever potential body-bonnet leaks, Vogt engineers have developed these new General Purpose valves with seal welded bonnet joints.

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The desirable safety feature of a back seat on the stem is retained while still offering the elimination of a possible body-bonnet leak.

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Series 2801 Gate Valve
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FORGED STEEL
VALVES

A Report from the West Coast

Differences Muddy Waters of Feather River Plan

RALPH S. TORGERSON
West Coast Editorial Representative

A CONTROVERSY attracting national attention has been stirred up by California's $1.75 billion Feather River and Delta water project. A board of consulting engineers, set up to investigate the project, has reported its findings to Governor Brown, and the voluminous report, published by the State, appears as a bulletin (Number 78). Six of the consultants, A. H. Ayers, John S. Longwell, Carl R. Rankin, Roger Rhoades, David Weeks, and chairman Ralph A. Tudor, submitted a majority report agreeing with the California Department of Water Resource's selection of Aqueduct System B and the feasibility of its financing as a self-supporting project.

However, a minority report was filed by Adolph J. Ackerman (See cover story, August 1959) challenging the plan's financial soundness. He suggested the issuance of revenue bonds rather than general obligation bonds, and pointed out that financing under the proposed plan could result in a debt status of $2.73 billion at the end of the contemplated construction period in 2009. He held that the majority report estimates of interest rates and future costs of construction were not realistic.

Ackerman also questioned the idea of the State building its own steam plants to generate power for pumping. He suggested a pumping scheme making use of off-peak electrical energy from privately owned utility systems combined with on-peak generation of energy in the power recovery plants south of the mountains. The generated energy could be returned to the utility systems.

Harvey O. Banks, director of the Department of Water Resources, replying to the minority report, held that the financial analyses of the aqueduct systems do not foresee the large operating deficits implied by Ackerman. The director also stated that further studies are contemplated on methods of pumping and power recovery.

The first independent study of the project was made in 1955 by the Bechtel Corporation. At that time, the California Legislature appropriated $250,000 for its Joint Interim Committee on Water Problems. This report found the project to be feasible on both an engineering and financial basis.

Scope of the Studies

Specific objectives of the current investigation include:

¶ Determination of probable future requirements for supplemental water from northern California in the southern California area, and the rate of growth in demand for such water after it has been introduced into the several areas under consideration.

¶ Determination of the probable dates when water from northern California will be required in the several areas.

¶ Designation of the areas to be served by an aqueduct system to the southern California area.

¶ Selection of the most favorable, or optimum aqueduct system to serve those areas. In accordance with the authorizing legislation, this entailed a study of alternative coastal and inland aqueduct routes for delivery of water south of the Transverse Ranges; a study of aqueduct routes for water service in the southern San Joaquin Valley; and a study of aqueduct routes through San Bernardino and Riverside Counties for water service there and in San Diego County.

Several pumping and power recovery schemes for the alternative routes considered were evaluated to ascertain the influence of the scheme on the selection of aqueduct locations and capacities. Appropriate financial and economic analyses were made in order to compare the various systems.

These studies were initiated under authority of the Burns-Porter Act passed by the 1959 Legislature. The California Department of Water Resources, formerly the Division of Water Resources of the

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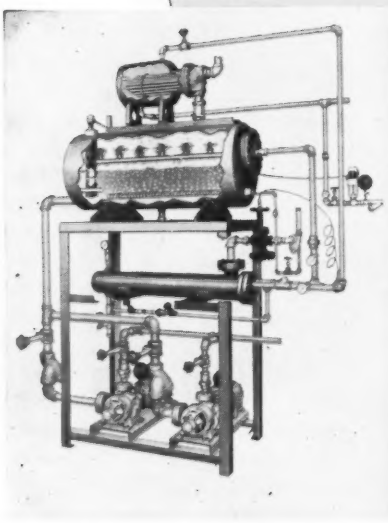

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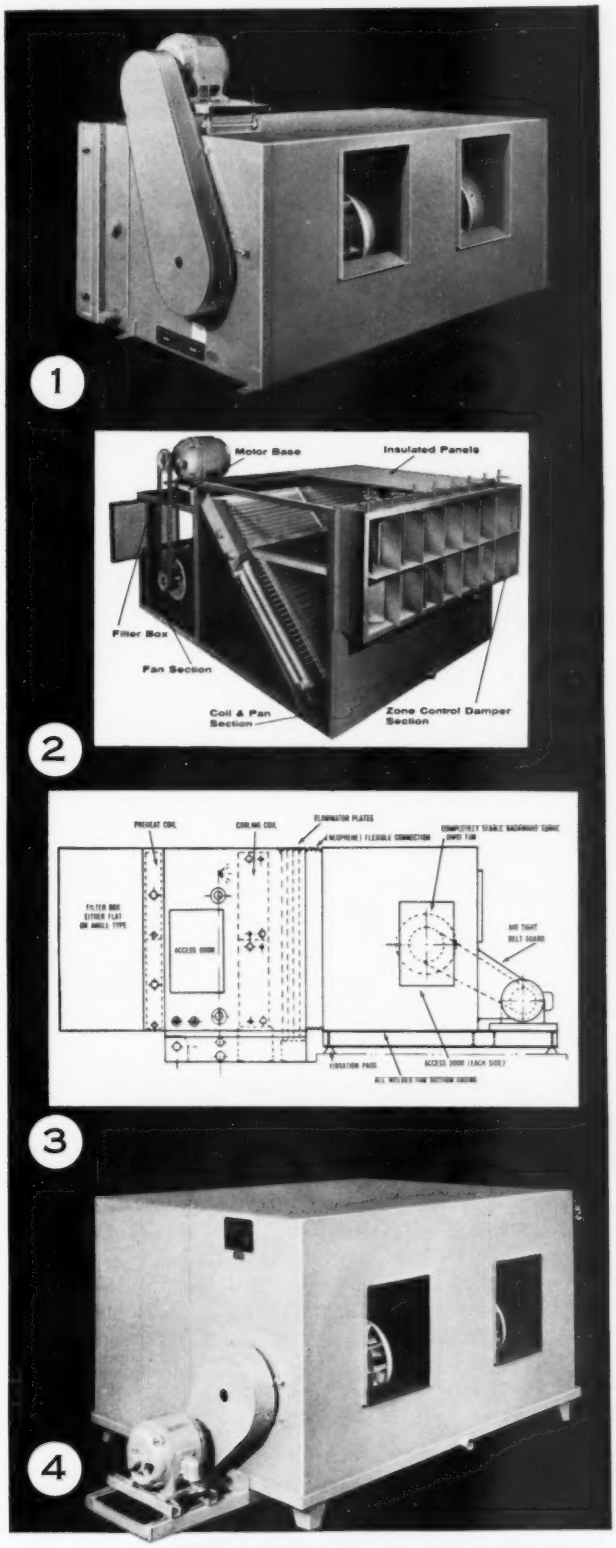
Department of Public Works, started functioning on July 5, 1956. The Department now has about 1500 employees, and under the law must not employ any outside personnel or consultants for planning and design unless such professional abilities or services cannot be found in the Department's civil service personnel. This is the same situation that prevails in the Division of Highways and other divisions of the Department of Public Works.

However, despite the law, the Department of Water Resources has drawn upon outside consultant services more than any other department of the State government. The Department's engineering staff will handle much of the aqueduct design, but where the project ties in with the Federal Bureau of Reclamation, design will be undertaken under the jurisdiction of the Bureau. Private engineering consultants undoubtedly will be employed for the design of the power, pumping, and storage facilities.

Feather River Project

The controversy over the Feather River project stems from the fact that northern California has the surplus water, while the southern area has the population, most of the industry and agriculture, and not enough water to meet its present and future needs. The northern part of the State has been reluctant to commit its surplus to the south. It wants to reserve sufficient water for its future growth, and it does not care to obligate itself with taxes to support a water program which offers it no benefits except some flood control. The Burns-Porter Act, passed after much debate, does guarantee the northern part of the state's water rights. But the bond issue to finance the project must be voted upon in the forthcoming November 1960 general election.

Investigation of Feather River and Diversion Projects included



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three alternative aqueduct systems to serve southern California. It finally was decided that the inland system, known as System B, would be the most desirable from the standpoint of least capital cost, least average cost of water, best distribution of water south of the Techachapi Mountains, and most favorable power recovery. System A is primarily a coastal route, and System C is a combination of coastal and inland routes.

System B extends from Avenal Gap in Kings County along southern San Joaquin Valley and across Techachapi Mountains. It traverses the mountains through a series of pumping plants, penstocks, and tunnels to Cottonwood Creek. Here the inland aqueduct divides into western and eastern branches.

The western branch would continue from Cottonwood Creek in tunnels, siphons, power drops, reservoirs, and canals through Castaic Reservoir and on to the Balboa Terminus in the San Fernando Valley. The eastern branch would extend from Cottonwood Creek through a power drop, canals, and pumping plants, traversing the desert area to Cedar Springs Reservoir, on the headwaters of the Mojave River. In this section, water would be diverted to the Antelope-Mojave and Whitewater-Coachella areas. From Cedar Springs Reservoir, the branch would tunnel through the San Bernardino Mountains and continue through power drops, afterbays, and siphons to the proposed Perris Reservoir.

A coastal branch would divert water from the main aqueduct at Avenal Gap and proceed by pumping and power recovery plants, canals, tunnels, and siphons to a terminus in Santa Maria Valley in Santa Barbara County, servicing enroute the upper Antelope Plain and San Luis Obispo County.

Board Recommendations

The board of consultants, in its conclusions favoring System B, stated that while it required higher pumping lifts for larger quantities of water than alternative systems, it would require only about 16 percent more fuel oil for pumping purposes than would be required by a coastal aqueduct. Large financial benefits would be realized by power-recovery methods.

It also took the position that maximum advantage should be taken of the integrated facilities of the public utilities in the area, using lower-valued utility-generated off-peak power for pumping and generating higher-valued peaking power for sale. Direct steam-driven pumping schemes were rejected as unreliable.

The board also recommended further serious study of staging and timing of aqueduct construction. "Prognostications of events in the distant future," it stated, "are uncertain because of possible changes in economic trends and technological advantages now un-

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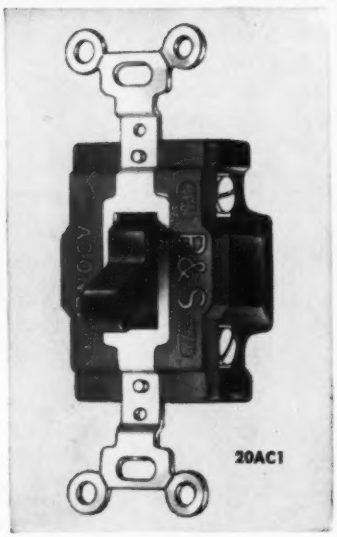

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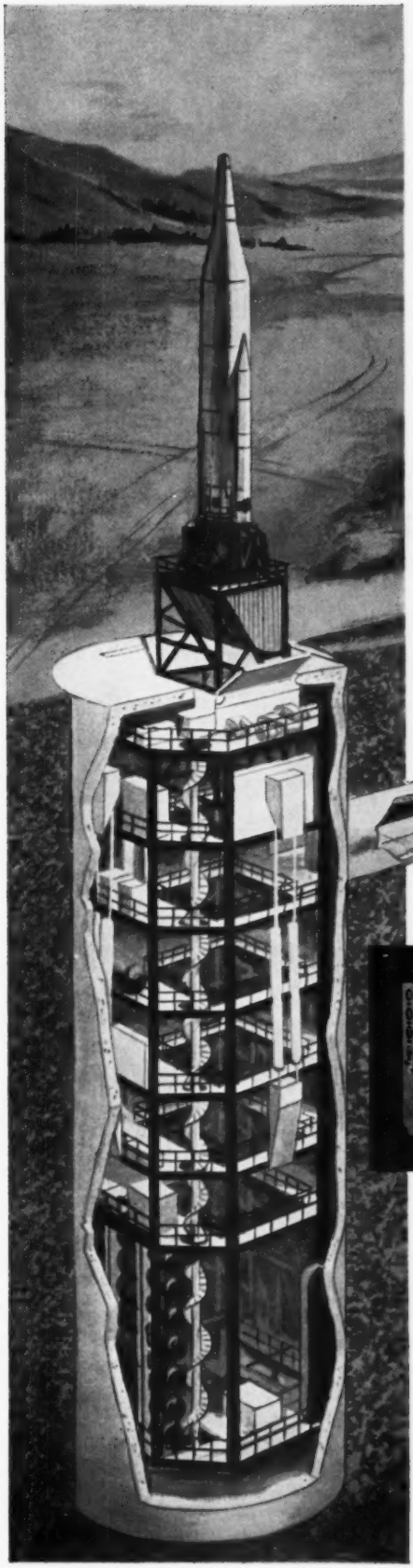

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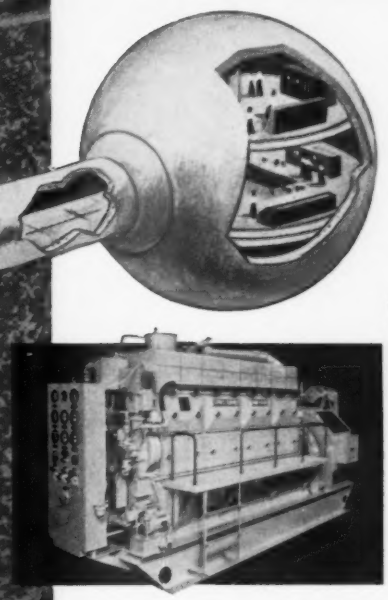

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foreseen. For these reasons, initial construction to the capacities now estimated for the distant future involve unpredictable uncertainties – the works built to meet these anticipations could be smaller or larger than ultimately necessary."

Capacities

Aqueduct System B contemplates maximum delivery of 3.2 million acre-feet of Feather River water to southern California. The project would involve 479 miles of flume and canal, 31 miles of tunnel, 114 miles of siphon and penstock, and 14 miles of miscellaneous systems of water conveyance for a total of 638 miles. There would be 10 pumping plants with net operating heads ranging from 525 to 3166 feet. Six power recovery plants would range up to 1988 feet in net operating head. The regulatory reservoirs and storage capacity in acre-feet are as follows: San Luis, 2.1 million; Beartrap, 56,000; Castaic, 150,000; Cedar Springs, 216,000; and Perris, 148,000.

The investigation did not cover facilities located north of Avenal Gap in Kings County. These facilities include the Oroville dam, reservoir, and power plants; the upper Feather River Basin features; the Delta water project; North Bay aqueduct; South Bay aqueduct; San Luis dam and reservoir; the Delta to San Luis canal; the San Luis canal, Pacheco Pass tunnel aqueduct; and the San Joaquin Valley drainage system. All these facilities are to be financed under the Burns-Porter Act and are not within the purview of this investigation.

Other Water Sources Examined

However, the investigation did examine other sources of water such as reclamation of sewage, desalinization of water, and sea water conversion by nuclear power. It was determined that reclamation of 40 percent of 600,000 acre-feet of sewage discharged in metropolitan areas of southern California could be reclaimed at a cost of from $13 to $40 per acre-foot, but excess mineral content would result in a limited market, and the increasing use of detergents would create a problem.

Desalinization of water from Imperial Valley could be accomplished by the membrane demineralization process, reducing mineral content from 2000 to 500 ppm. The cost, however, would be $140 per acre-foot. Adding the cost of transportation and maintenance brings it to $185 per acre-foot.

Sea water conversion costs range from $160 to over $600 per acre-foot, depending on the method, plus additional costs for pumping and conveyance.

For purposes of comparison, the cost of imported water (Colorado River in most instances) ranges from a low of $35 per acre-foot to $168 per acre-foot. In the majority of communities the cost averages

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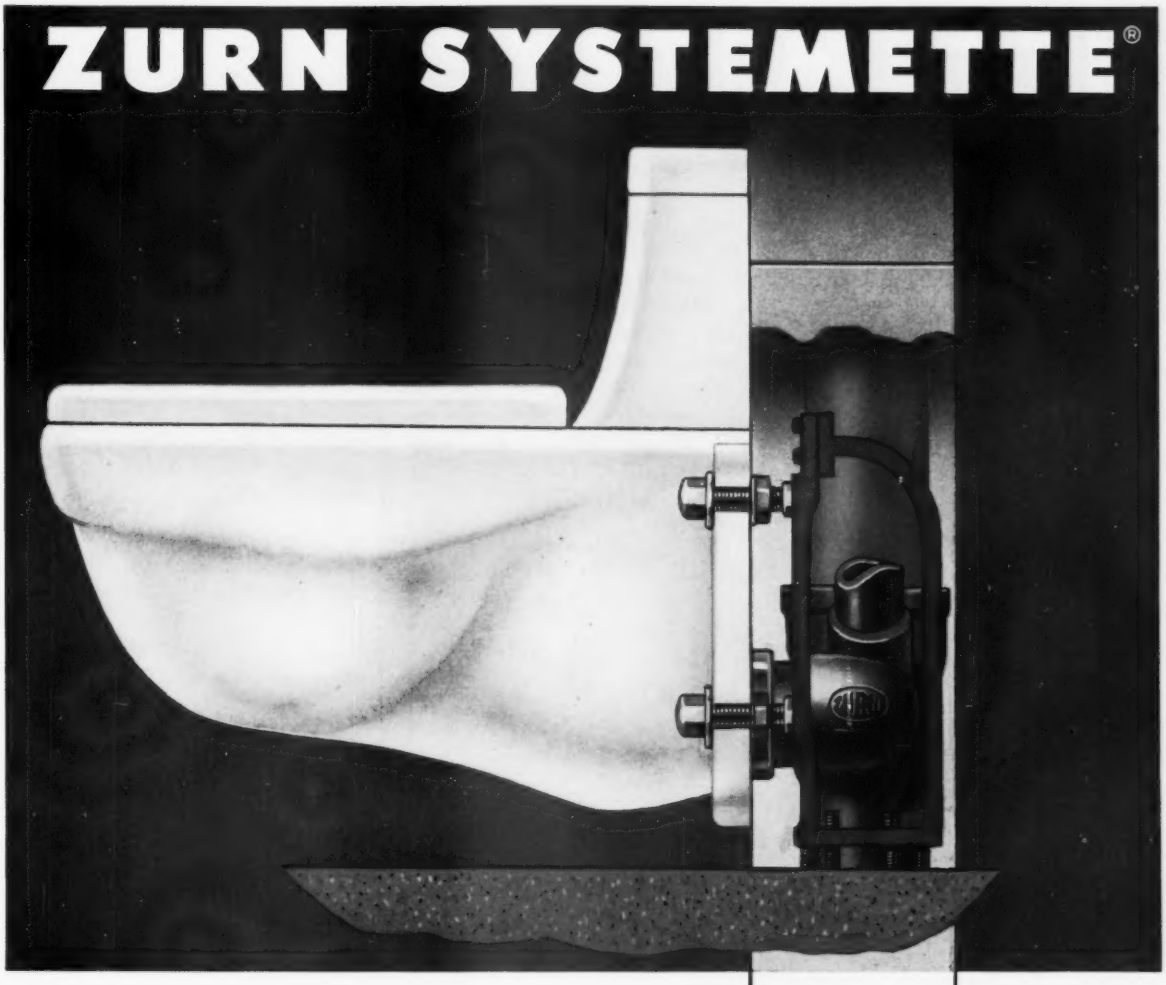

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$75 per acre-foot, which includes distribution costs beyond principal conveyance systems.

Studies were based on an increase in population in southern California from 8,705,500 in 1958 to 13,100,000 in 1970, and to 28,550,000 in 2020. The population of the entire state is estimated at 21.7 million for 1970 and 56 million for 2020.

Still, until the recent decision for distribution of Colorado River water made by Special Master Simon H. Rifkind, appointed by the United States Supreme Court, the City of Los Angeles did not feel a sense of urgency in promoting the Feather River project. It had its own source of supply in the Owens River reservoir plus Colorado River water. But the Rifkind recommendations will cause serious problems by 1970.

An even more acute problem is faced by San Diego County. Under the terms of the Colorado River Compact of 1922, California, Arizona, and Nevada divide 7.5 million acre-feet of the River's flow, and Colorado, Utah, Wyoming, and New Mexico divide another 7.5 million acre-feet. Rifkind ruled that California and Arizona would share equally any surplus in the lower basin of the Colorado above 7.5 million acre-feet. The lower basin is the drainage area south of Grand Canyon. If the stream flow is less than 7.5 million acre-feet, Rifkind ruled that it would be apportioned so that California would receive 44/75 of the total, Arizona 28/75, and Nevada 3/75.

Need Will Pyramid

At present, this formula would not affect California since the upper basin states are not using their allotment – Arizona taking only 1.4 million acre-feet of its share and California only 4.7 million. By 1963, however, Glen Canyon reservoir in the upper basin is expected to begin filling to its eventual capacity of 30 million acre-feet. In the meantime, Arizona may start its own big Central Valley projects. Thus, it is estimated that within a decade the average flow in the lower basin will be down to about 6 million acre-feet. Of this, California would receive 3.5 million acre-feet, all largely exhausted by the priorities of the Imperial, Coachella, and Palo Verde Districts in inland California. The Metropolitan Water District, serving Los Angeles and San Diego Counties, would be left only a trickle.

This recommendation by Rifkind, if upheld by the United States Supreme Court, points up the urgency of early construction on the Feather River project. The problem of water supply for the San Diego County Water Authority, part of the Metropolitan system, is particularly urgent as it uses 60 percent of all the Colorado River water taken by the Metropolitan member districts. ▲▲

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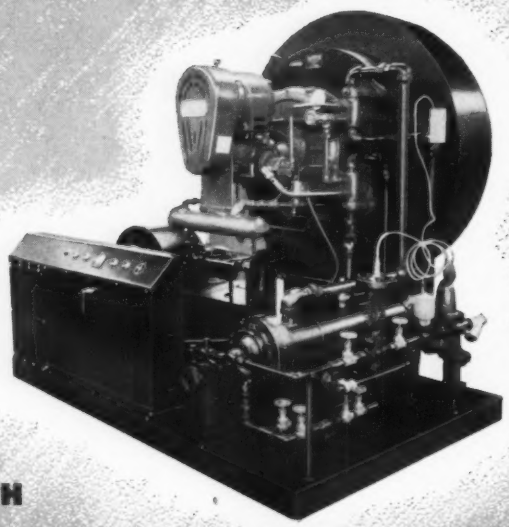

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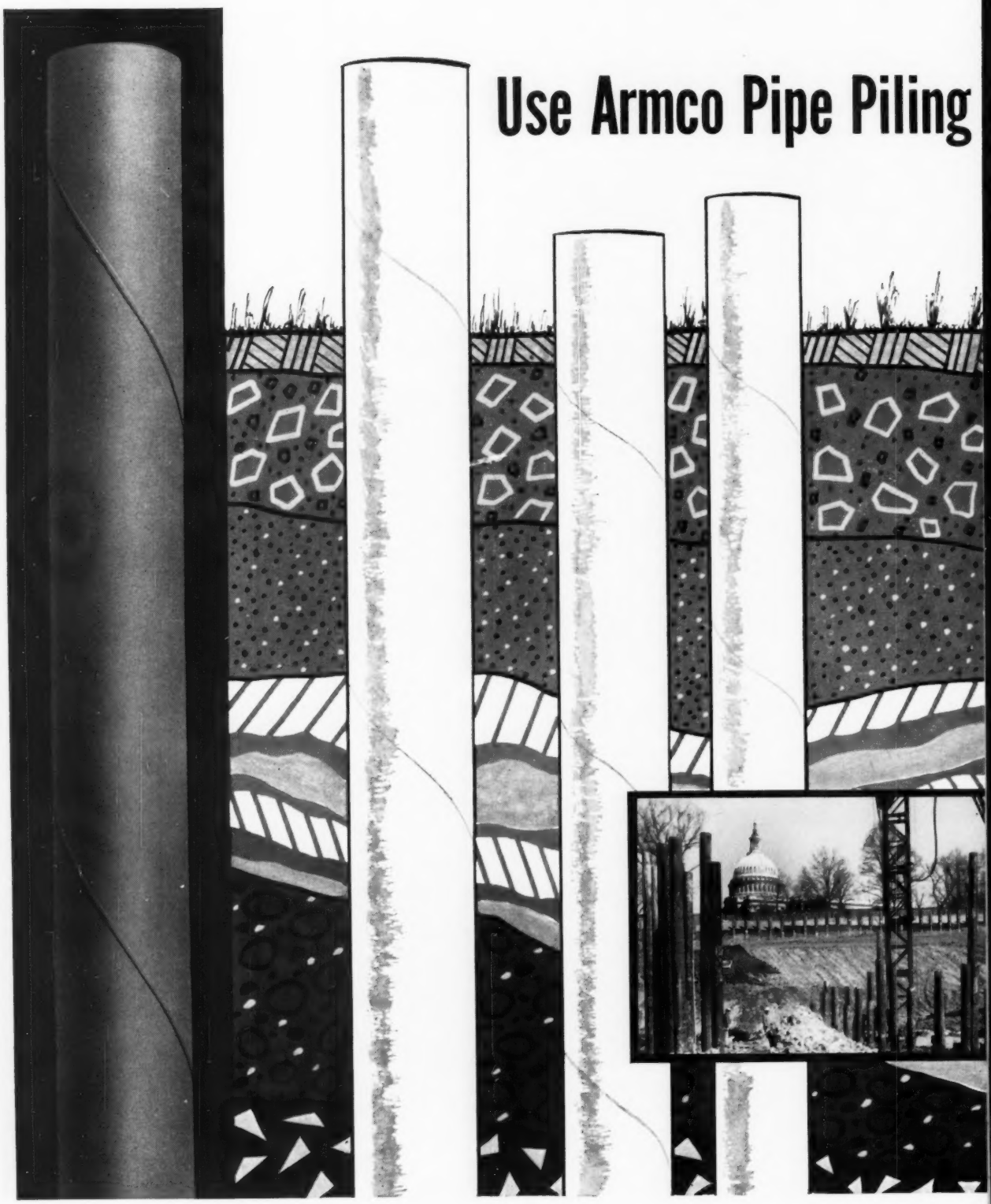

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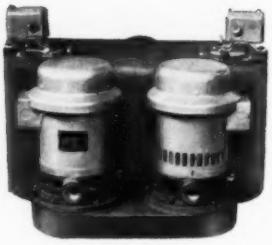

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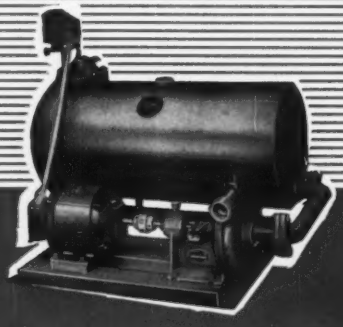

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Florida Surveys Its Engineers and Scientists

MARJORIE ODEN, Eastern Editor

THE MOST comprehensive survey of engineers and scientists yet undertaken, at least on a statewide basis, has been issued as part of a Science and Engineering Center study at the University of Florida. It was conducted under the direction of Dr. Thorndike Saville and financed by a Ford Foundation grant, made early in 1958.

Data on present and projected future employment of engineers and scientists was required in connection with the study, which deals with effective and coordinated development of the several colleges of the University, to best meet the future needs of the State of Florida in supplying the necessary scientists and engineers.

Statistics Are Impressive

The section of particular interest is the "Inventory of Engineers and Scientists Employed in Florida in January 1958, and Employment Projected to 197X" (the term 197X is used in projecting future employment to some year between 1970 and 1980). This documentary not only reveals in detail how many engineers and scientists currently are working in Florida and what they are doing, but also forecasts what substantial increases in technological personnel will be needed to keep pace with the impressive growth rate of the State.

In taking the survey, Florida did not rely on sampling techniques. Instead, questionnaires were sent to all major employers of scientists and engineers – the manufacturing, processing, mining, and construction industries as well as educational institutions, government, agencies and consulting and laboratory service organizations.

Survey Findings

Here is what the survey revealed regarding the numerical count of engineers and scientists.

In January 1958, there were 11,170 engineers employed in Florida. Predicted need for 197X is 33,310 engineers – an increase of 198 percent. Scientists will be in even shorter supply in the year 197X. On the survey date, Florida had 5235 scientists; by 197X there will be a need for 11,725 – an increase of 224 percent.

Today, the vague category "selected engineering services" (including consulting engineers and research laboratories) employs 2201 Florida engineers, more than any other category in the survey. By 197X, it is estimated that 6260 will be needed.

The second largest concentration of engineers is to be found in the classification encompassing the various levels of government. Government accounts for about 17.5 percent of the engineers employed in Florida.

The board field Transportation, Communication, and Utilities constitutes the third most important classification in terms of the number of engineers employed in the state. The generation and distribution of electric power, telephone communication, and the airlines and railroads account for most of the engineers in this group. Eleven percent of the engineers are to be found in this classification.

Half in Service Activities

It is very interesting to note that these three classifications constitute just under 50 percent of the total number of engineers. The engineers in this group are either directly involved in the provision of services or they are employed in support of service activities."

Construction work accounted for employment of 9.7 percent of Florida's engineers.

Among manufacturers with staff engineers, "two categories stand virtually tied as major sources of engineering employment. They are Transportation Equipment, and Machinery and Related Equipment. The former consists primarily of the aircraft industry and accounts for 7.7 percent of the employed engineers in Florida. The latter, which chiefly includes elec-

trical machinery and electronic components accounts for 6.3 percent of the number of engineers."

Type of Work

In classifying according to specialists, engineers were tabbed according to the work they are doing — not according to their degrees. It was found that among the "services" engineering employees, approximately 30 percent are classed as civil engineers; 23 percent electronics; 12 percent mechanical; 8 percent administrative; 6 percent electrical; and the rest "other."

Nondegree engineers also were studied in the survey. These are employees who are "classified as engineers by their employer and who are performing work requiring the knowledge customarily expected of a first degree engineer. Industry often gives an engineering title to such persons because of attainment, or as an incentive to self-study, or because of the scarcity of first degree engineers."

A study by degree shows that "Of the engineers in Florida, 80 percent were employed by private enterprise, 18 percent by government, and 2 percent by higher education." And "70 percent had first degrees (Bachelor or equivalent), 23 percent had no degree, 6 percent Master's degrees, and only 1 percent Doctor's degrees. By area of employment, 81 percent of the first degree and of the nondegree engineers were in private practice, as were 73 percent of the Master's and 47 percent of the Doctor's degree engineers." For the United States, the nondegree component of all engineers ranged from 28 percent in 1930 to 20 percent in 1950, according to earlier Engineers Joint Council studies.

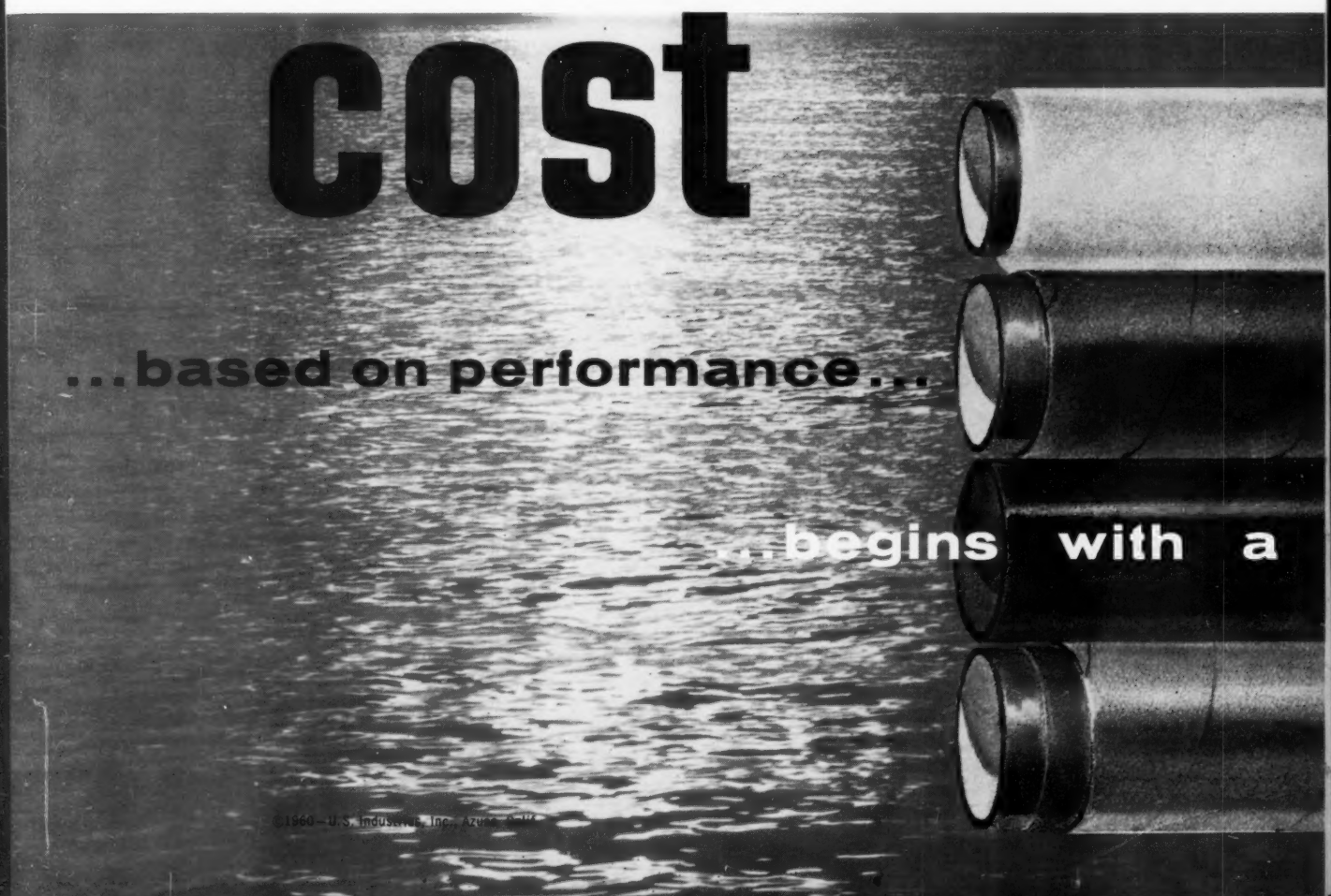
In the consultants' category, about 68 percent of the employees have Bachelor's degrees; 10 percent Master's; and the rest none.

Two fields leading the educational average were Paper and Allied Products, and Chemicals and Allied Products. In both, 95 percent of the engineer employees are college graduates.

Fields of Engineering

Then, the engineers were classified according to the branch of engineering they studied in college:

"Civil engineering, including sanitary engineering, constitutes the largest grouping shown, accounting for 20.3 percent of all reported degree engineers. The next greatest concentration of engineers is indicated to be in mechanical engineering, making up 16.9 percent of the total. The fields of electronic and electrical engineering follow in that order of numerical importance, accounting for 14.8 percent and 13.8 percent of all the degree engineers reported, respectively. Administration absorbs 9.7 percent, while chemical engineering takes care of another 5.9 percent of the total. Other categories deserving of mention are aeronautical engineering and industrial



engineering, which account for 3.7 percent and 2.9 percent of the total in that order."

Technical Study Cited

A reference also was made to a report called "Technicians for Florida Industries," conducted by the State Department of Education last year. This study said nearly 12,000 technicians were employed in 17 Florida counties in 1959, and predicted that over 15,000 would be needed by 1963.

"No adequate data exists to enable reasonable projections of technician employment in 197X to be made. However, the State Department of Education report, indicating the need for 3000 additional technicians in the next three years, offers impressive testimony that provision for training large numbers of such persons should be made," the survey states.

The study showed that 1150 out of 8353 technicians in Florida in 1958 worked on engineering and architectural services. Also, engineering and architectural services average 72.8 technicians for every 100 employed engineers.

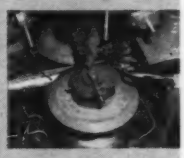
Basis for Assumptions

In conclusion the survey states:

"The estimates assume a growth of the State and national economies that may be interrupted by recessions of the type that have occurred since World War II but not seriously slowed down by a depression similar to that of the 1930's. In 1958, companies under contract with governmental agencies for at least 50 percent, and usually 100 percent, of their output accounted in Florida for 23 percent of the engineers and 11 percent of the scientists. The estimates are predicted on the continuation of the 'Cold War' and defense-oriented industries, or, if armaments are drastically curtailed, the substitution of other industries requiring engineers and scientists." ▲▲

Which is best?

Seldom is a decision more critical and seldom is a choice more necessary than in selecting the proper water line to do the job. There is really only one long range measurement to follow—*performance cost.*



Performance cost is not so much considered with initial outlay as it is with the relation of performance to cost over time under varying conditions, standard as well as emergency. And When performance cost is the measure—steel water pipe is your only choice.

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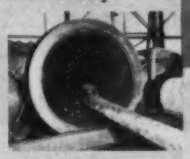

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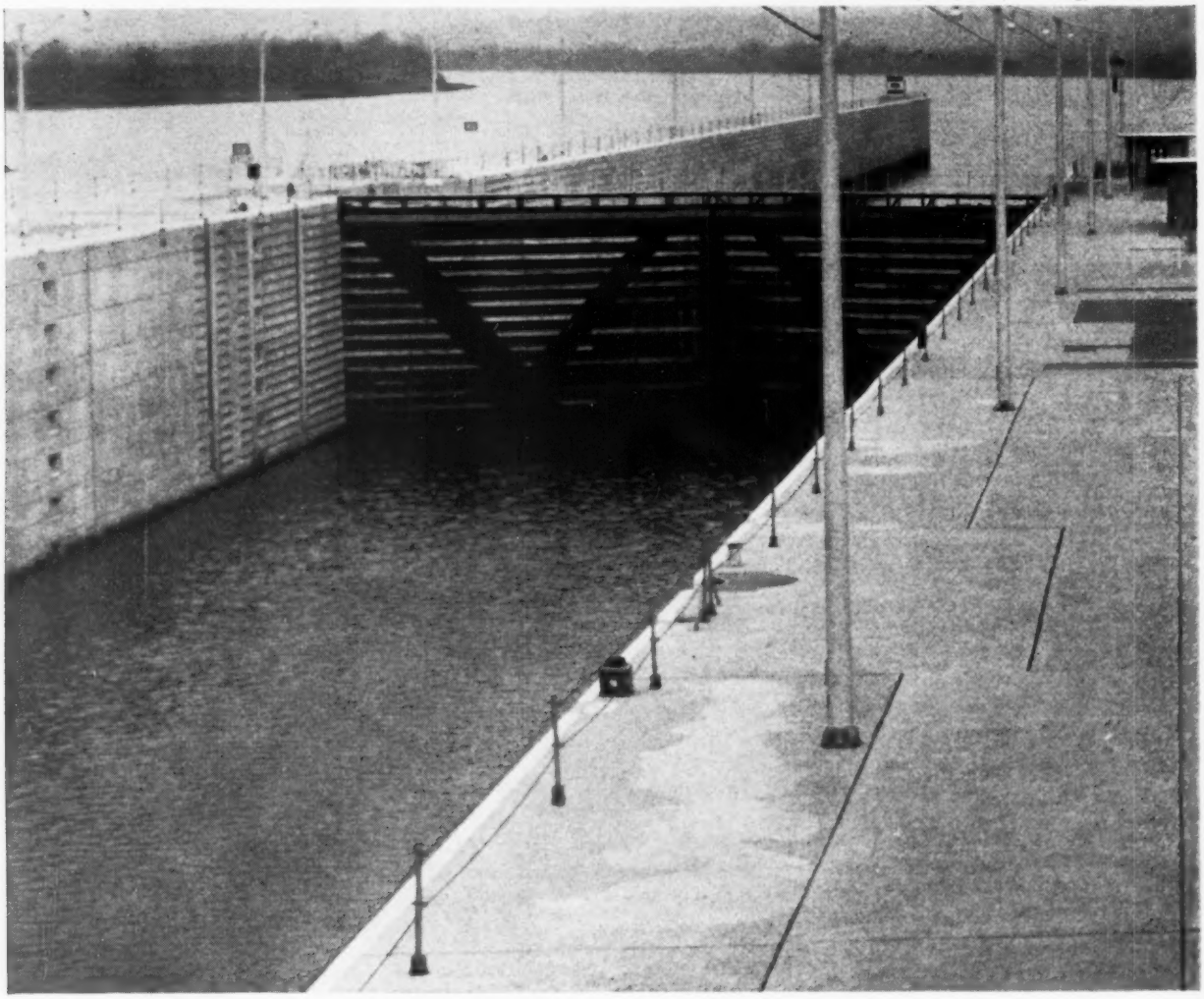


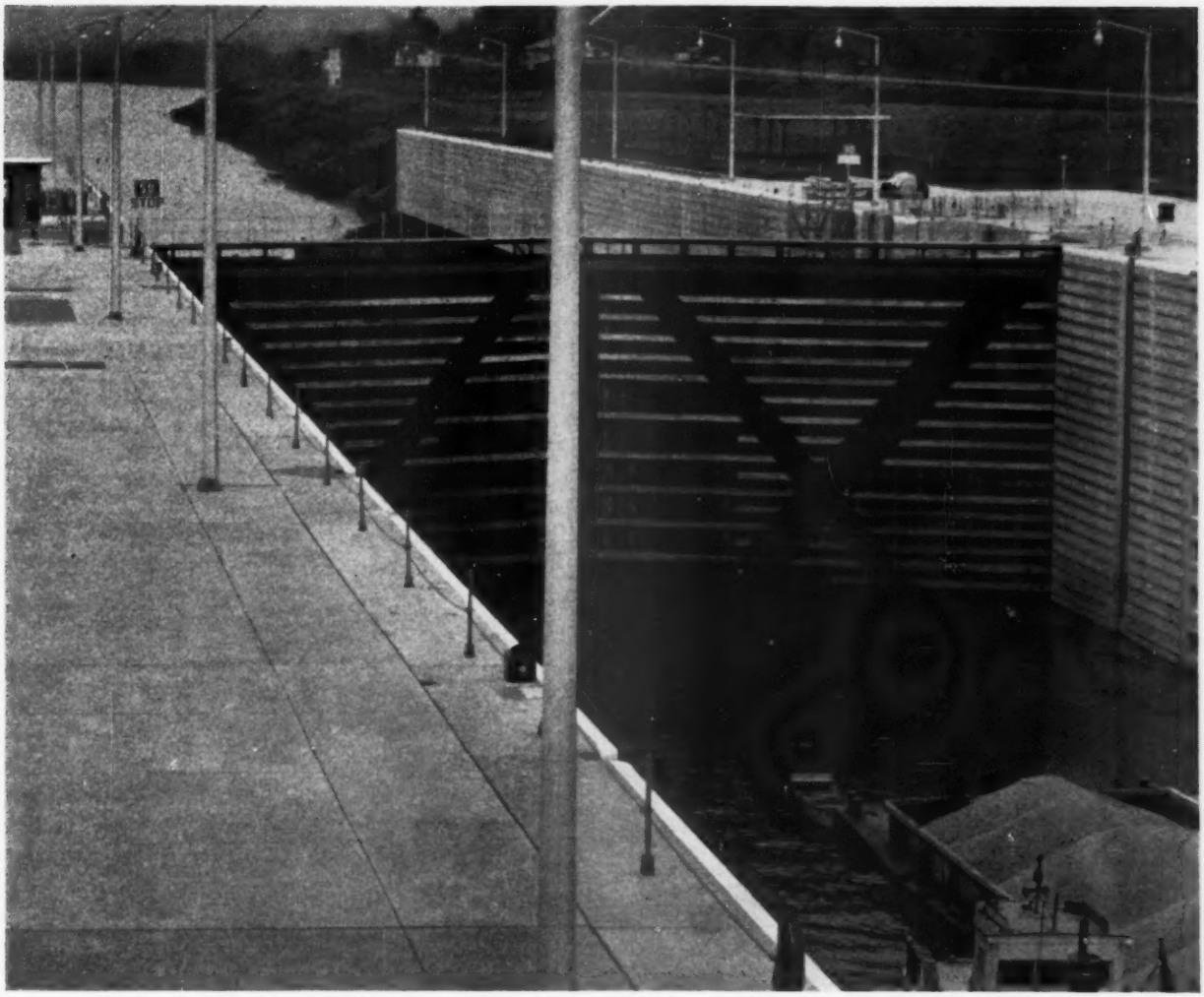
USS "T-1" Steel saves 289 tons

This is a story about how the tremendous strength of USS "T-1" Steel was utilized to save 289 tons of weight in the lock gates at the new Greenup, Kentucky and Markland, Indiana locks and dams on the Ohio River. Each lock gate has five diagonal braces that were designed for USS "T-1" Constructional Alloy Steel. At Greenup, it was estimated that 64 tons of "T-1" Steel did the work of 213 tons of carbon steel in eight gates. At Markland, shown in the picture above, 60 tons of "T-1" Steel were used instead of 200 tons of carbon steel to do the same job.

The diagonal units provide the supports which are absolutely essential to brace the gates. Each diagonal is a flat bar 8 inches wide by 1½ inches thick and about 73 feet long and weighs around 3,200 pounds. Toward the center of the diagonal is a turnbuckle used to adjust tension. By using USS "T-1" Steel, which has a minimum yield strength of 100,000 psi, both the size and weight of the diagonals were greatly reduced while retaining an ample factor of safety.

Lower costs. Reduction in weight because of the use of USS "T-1" Steel meant lower overall material costs, reduced shipping costs by more than one third and decreased handling and erection costs.

Greenup & Markland Lock and Dam Construction: Supervised by Huntington and Louisville District, United States Army Corps of Engineers



# of weight in 16 lock gates

USS "T-1" Steel for hoists. Four hoists for the emergency gates at Greenup locks and dam were also built of USS "T-1" Steel by McNally Pittsburg Mfg. Co., Pittsburg, Kansas. The structures are girder sections about 25 feet long and 41 inches deep. Flanges are 20 inches wide by 2½ inches thick. The webs are 36 inches deep by 1¼ inches thick. All were fabricated from "T-1" Steel plates. Each girder weighs about 12,000 pounds.

The new locks and dam on the Ohio River at Greenup, Kentucky were built under supervision of Huntington, W. Va. District, U. S. Army Corps of Engineers. A similar set of locks at Markland, Indiana was built under the Louisville District, U. S. Army Corps of Engineers.

Other uses of USS "T-1" Steel in construction. Wherever great strength is needed with least weight, such as in bridges, TV towers, pressure vessels, and high pressure penstocks, USS "T-1" Steel is unsurpassed because of its high yield strength, high resistance to impact abrasion, and weldability. For complete information write for our "T-1" book. United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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Efficient temperature control will be just as essential in your clients' buildings in 5, 10, 20, or more years as it is today.

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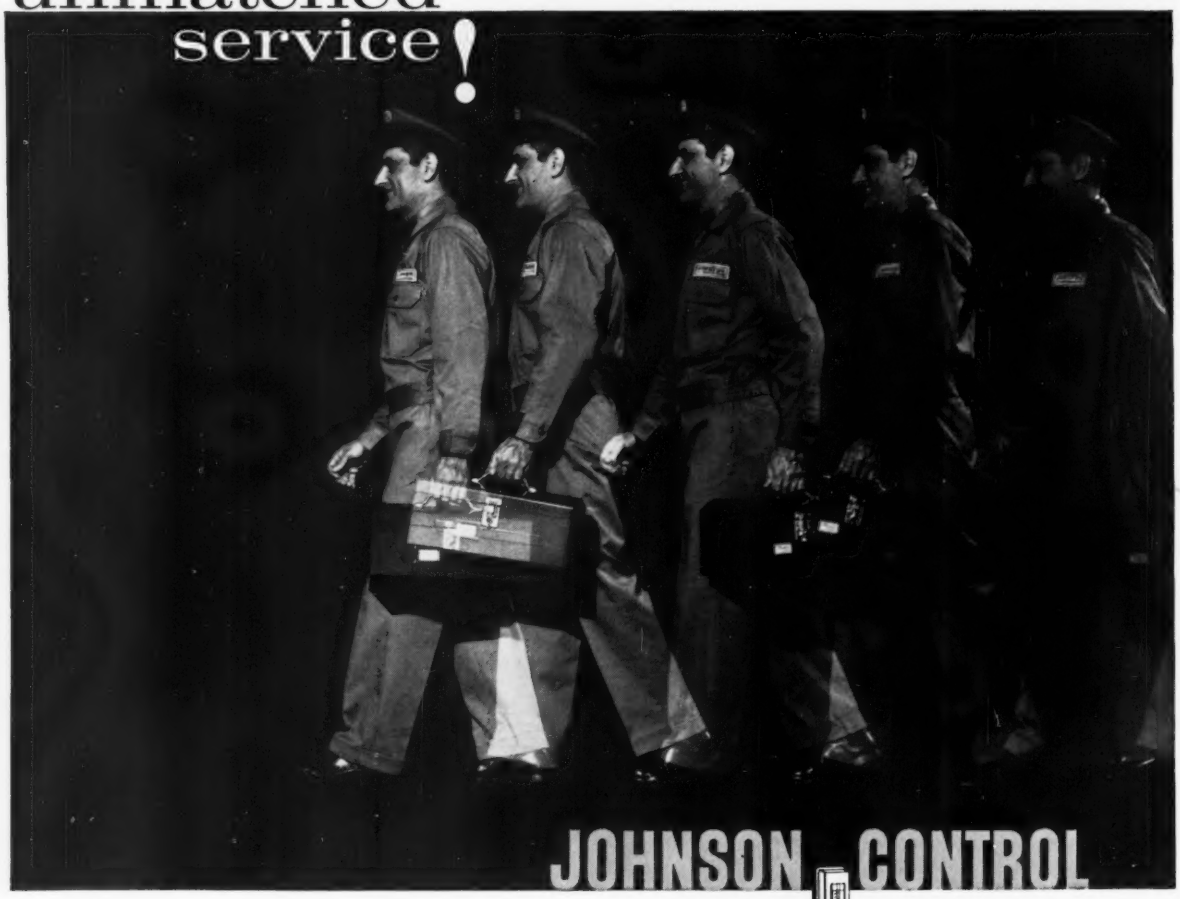

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Heard Around Headquarters

MARJORIE ODEN,
Eastern Editor

NOBODY is quite sure what the American Nuclear Society and the Atomic Industrial Forum are mad about, but the situation on future nuclear shows grows ever more ridiculous.

Since ANS and the Forum announced last year that they no longer would cooperate with the Engineers Joint Council on nuclear shows, EJC has done everything possible to get the shows together.

EJC was planning a Nuclear Congress in Chicago next year, but dropped the plan when it was learned that ANS and the Forum show is scheduled in Chicago for 1961. Then an EJC committee was given carte blanche permission to accept any reasonable suggestion for getting the shows together.

After dropping plans for a show next year, EJC booked the Coliseum in New York City for a 1962 show in June. So then they learned that ANS is having a 1962 meeting in Boston – in June. Another plea was sent to ANS to at least hold their meeting in New York City at the same time as the Nuclear Congress, even if there was to be no connection. This way, nuclear engineers and scientists could attend both the Congress exhibition and the ANS sessions. ANS answered – No.

Get Together on Building Materials

A new group, the Modular Building Standards Association, has been formed by representatives of the American Standards Association, the American Institute of Architects, the Producers' Council, the National Association of Home Builders, and the Associated General Contractors of America. Purpose is to work out dimensional standards for all major categories of building materials.

Explaining its reason for being, the Modular Standards group said "In 1945 the 4-in. module was adopted by the building industry to serve as the basis for sizing all building products. Since that time, the continued introduction of new modular products and the conversion of many traditional items to modular sizes has made it imperative that all types of products be given the opportunity to benefit from more detailed dimensional standards. Jointing methods, assembly with other modular materials, tolerances, and clearances are all considerations essential to achieving the full benefits of a dimensionally simplified construction industry."

No consulting engineers are represented in this group setting tomorrow's building standards!

"Manpower" Unlimited

The Engineering Manpower Commission got quite a jolt the other day. It received a letter stating that the word "Manpower" is a registered trademark, and that EMC should stop using the word. Furthermore, the *Manpower Newsletter* (which has been an EMC publication for many years) also uses that trademarked word. Now the Engineering Manpower Commission is a little worried. What if someone also trademarks the word "Engineering?"

Specifications by Union?

The Indiana Society of Professional Engineers has been approached by at least one labor union with an appeal that engineers specify a particular brand because the manufacturer "now has an agreement" with the union, according to *Private Practice News*. President D. H. Lessig rejected the idea, explaining that there are things besides a union label to consider when writing specifications.

Form Joint Committee

The Consulting Engineers Council, the American Institute of Consulting Engineers, and the American Society of Civil Engineers have formed a joint committee to protest the corporate practice provisions of the Model Law, which is slated to be up for final consideration this month.

This is the first time the Institute and the Civils have gotten together with the Council to present a united front on anything. And membership on the joint committee is not limited. Invitations to join also have been sent to the other Founder Societies, the National Society of Professional Engineers, the

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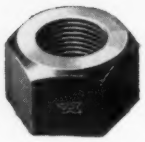
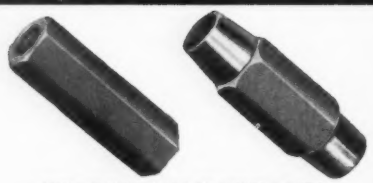


HEX, JAM AND SQUARE NUTS

THREADED AND LOOP RODS

RECESSED PIN NUTS AND PINS

HEX AND SOCKET HEAD CAP NUTS



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Canadian Council of Professional Engineers, and others.

The particular paragraph in the Model Law to which the joint committee object is:

"The practice, or offer to practice, of engineering, as defined by this Act, by individual registered professional engineers, through a partnership, joint stock company, or corporation, as agents, employees, officers or partners provided they shall be individually liable for their professional acts, and further provided that all personnel, of such partnership, joint stock company or corporation, who act in its behalf as engineers are registered under this Act or are persons practicing lawfully or are exempt under Paragraphs (b) or (c) of this Section; and further provided that all final plans, designs, drawings, specifications, and reports, involving engineering judgment and discretion, when issued, shall be dated and bear the seals and signatures of the engineers who prepared them."

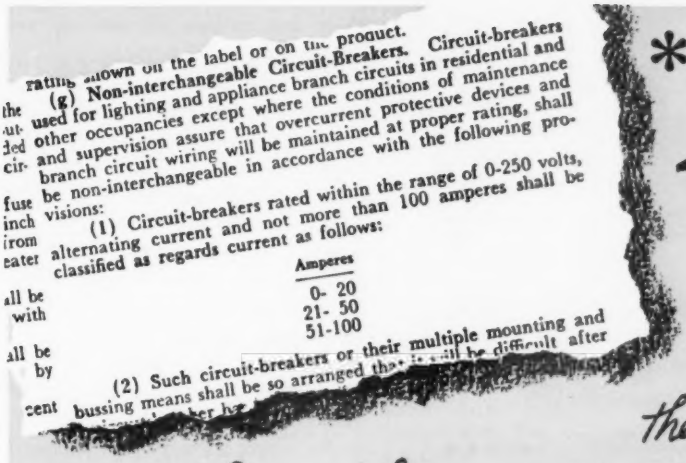
It is the part about allowing the practice of engineering by a corporation's agents or employees that is the point of contention. The term "employees" would be an invitation for manufacturers to go into free engineering, and the term "agents" would invite large corporations to set up engineering divisions and do consulting.

In a letter to National Council of State Boards of Engineering Examiners, the three summarized their stand:

"1. We have no objection to the corporate form of business arrangement being used . . . by a firm practicing Professional Engineering.

"2. We regard the practice of Professional Engineering as a Profession and not merely a commercial enterprise.

"3. We, therefore, object completely to conventional commercial corporations practicing Professional Engineering where, in effect, the licensed P.E.'s who are supposed to carry personal responsibility for



rating shown on the label or on the product.

(g) **Non-interchangeable Circuit-Breakers.** Circuit-breakers used for lighting and appliance branch circuits in residential and other occupancies except where the conditions of maintenance and supervision assure that overcurrent protective devices and branch circuit wiring will be maintained at proper rating, shall be non-interchangeable in accordance with the following provisions:

(1) Circuit-breakers rated within the range of 0-250 volts, alternating current and not more than 100 amperes shall be classified as regards current as follows:

Amperes
0- 20
21- 50
51-100

(2) Such circuit-breakers or their multiple mounting and bussing means shall be so arranged that it shall be difficult after

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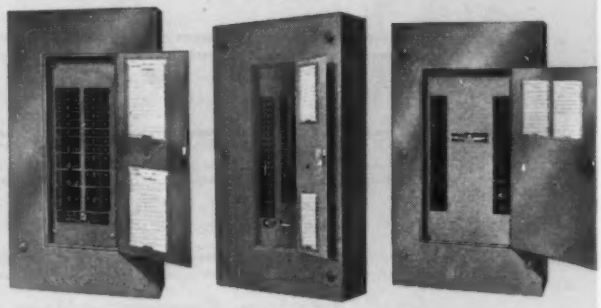

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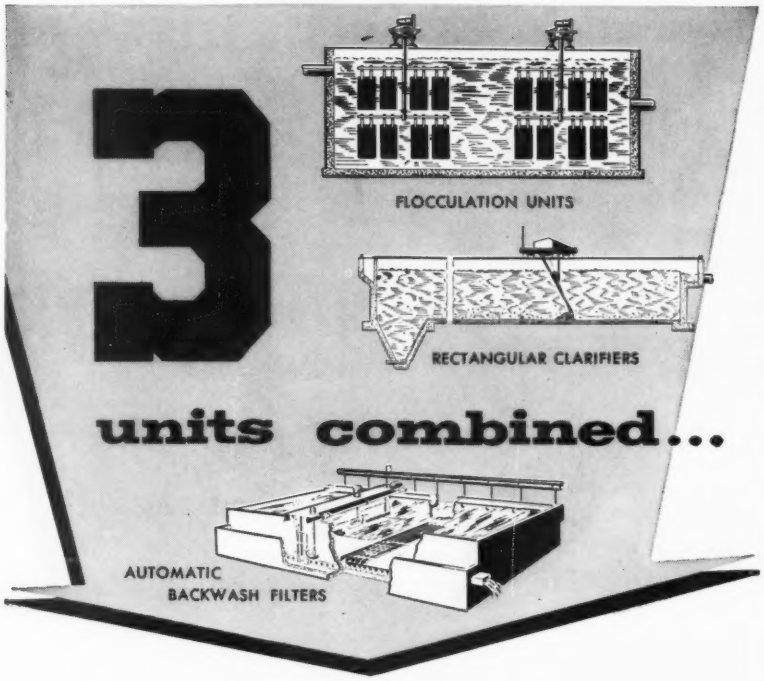
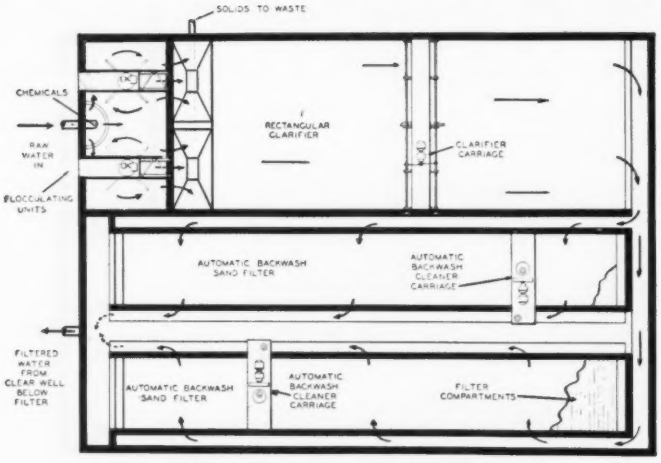


. . . for COMPLETE WATER TREATMENT



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their instruments of service, are merely employed persons.

"4. In accordance with the foregoing, we insist that where the legal corporate form of business structure is used, the control of such a corporation shall be in the hands of licensed P.E.'s, thus ensuring proper professional responsibility by the corporation in accordance with the principle expressed under paragraph (3) above.

"5. By the term 'control' in (4) above, we mean that a majority of the voting strength on the Board of Directors shall be in the hands of Licensed Professional Engineers, so as to ensure the effective direction of the corporation's operation by them.

"6. We fully appreciate the position of a commercial corporation manufacturing and selling a product which requires engineering design for its application, and we have no thought of restricting such engineering work where it concerns the corporation's product as such."

The joint group promised to have a proposed redraft of the corporate practice provisions for presentation at the August meeting.

Louisiana Registration

The Louisiana engineering registration law stands firm after a long battle by the Gulf Institute of Consulting Engineers (see "Heard Around Headquarters," May 1960). After an unsuccessful friendly suit against the state board of registration, the Institute was finally able to enlist the aid of the Louisiana Engineering Society (NSPE and EJC) and the State section of ASCE in preventing the legislature from lowering the barriers so that unqualified engineers could obtain registration.

With the engineers united, their uproar caused the questionable resolutions to be referred to committee by the legislature. At this point, the Senate resolution was withdrawn by its sponsor, and the

CONCRETE PERFORMANCE REPORT:

Pozzolith lends 5000 psi concrete high degree of workability in interesting new structure

The Munson-Williams-Proctor Institute Art Gallery, designed by Phillip Johnson and engineered by Dr. Lev Zetlin, makes use of a huge, post-tensioned criss-cross girder to produce an interior free of supporting columns. Calculations showed that this cast-in-place, 720-ton monolithic structural system, supported only at its eight extremities, provided a strength equal to sixteen 2′ x 2′ interior columns. Each of the girder's four 123′10″ sections contains 14 flexible post-tensioning cable conduits, four 4″ sleeves for balcony rods and a maze of reinforcing steel within its 10′9″ by 22″ cross section.

HUGE PRESTRESSED MONOLITHIC GIRDER—The structural system, weighing 720 tons and containing over 360 cubic yards of 5000 psi concrete was cast-in-place 50 feet above grade. The girder supports roof and hung balcony without interior columns. Facade will be covered with black Canadian granite, while girders and their supporting columns will be sheathed in bronze.

THE MUNSON-WILLIAMS-PROCTOR INSTITUTE ART GALLERY was designed by architect Phillip Johnson and engineered by Dr. Lev Zetlin, both of New York City. Supervising architects were Bice and Baird of Utica. The George A. Fuller Company, New York City, built the art gallery, with Jack Madden as project supervisor and William Gardner as engineer. The American Hard Wall Plaster Company, Utica, supplied the POZZOLITH ready-mix concrete. Pre-cast roof sections were supplied by Schenectady Concrete Products. Post-tensioning was by Pre-Stress, Inc. of Albany.

UTICA ART GALLERY

CONTINUOUS 16-HOUR PLACEMENT OF CONCRETE. To assure a completely monolithic member, all concrete for the girder was placed in a single, continuous operation. POZZOLITH retarded the hardening of the mix during placement, preventing horizontal cold joints.

The complexity of steel, coupled with the need for extended continuous placement of concrete to provide a truly monolithic girder, required a concrete mix which met these four specifications:

First, 5000 psi compressive strength to meet the prescribed design loads.

Second, a retarded set to assure a monolithic member completely free of horizontal cold joints and honeycomb.

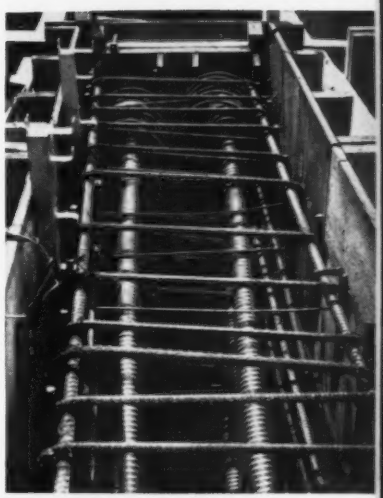
Third, a high degree of workability was required because of the complexity of steel reinforcement and conduits within each section.

Fourth, a low unit-water content for minimum shrinkage and over-all improvement of concrete quality.

The local Pittsburgh Testing Laboratory, the Alpha Portland Cement Company and the local Master Builders field men, developed a POZZOLITH concrete mix which had excellent workability and was easily placed with only 3½″ slump. It contained 20% less water than a comparable plain mix. POZZOLITH concrete gave the desired results in the monolithic girder, and in *all* the cast-in-place normal and lightweight concrete in this unique structure.

The Master Builders field men worked closely with project engineers, contractors, and concrete suppliers at the Munson-Williams-Proctor Art Gallery to achieve the common goal of uniform, superior quality concrete at lowest cost-in-place.

Write for your free copy of the *detailed* "Munson-Williams-Proctor Art Gallery Concrete Performance Report".



THE MAZE OF REINFORCING STEEL and 14 flexible conduits for the post-tensioning cables made high workability a must in the concrete mix design. Use of POZZOLITH resulted in low unit water content, yet gave a highly workable mix with 3½″ slump.

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House resolution was killed by being reported "without action."

NSPE Elects

Noah E. Hull has been elected president of the National Society of Professional Engineers. Among the six new regional vice presidents, three are consulting engineers: Brandon H. Backlund, Omaha, Nebraska, North Central Region; Thomas T. Mann, Roswell, New Mexico, Southwestern Region; and John H. Stufflebean, Tucson, Arizona, Western Region.

ASME on Unity

At the National Society of Professional Engineers annual meeting in Boston, it was announced that NSPE, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers were going ahead with the Functional Plan for Unity, hoping the other societies and Engineers Joint Council would go along with the idea later.

After the meeting, the Mechanicals had a few words to say – officially – on the subject of unity. According to R. B. Smith, chairman of ASME's Intersociety Relations Committee: "Over the years a number of approaches to the problem of unity have been advanced. None of these approaches has been finally rejected. None has been fully accepted. All are being considered."

Do It Yourself Public Relations

The Consulting Engineers Council and the American Society of Civil Engineers both recently released public relations brochures, and the two complement each other.

The CEC booklet, "You and Public Relations," tells the consultant what his best friend might not mention – about personal appearance, telephone manners, etc.

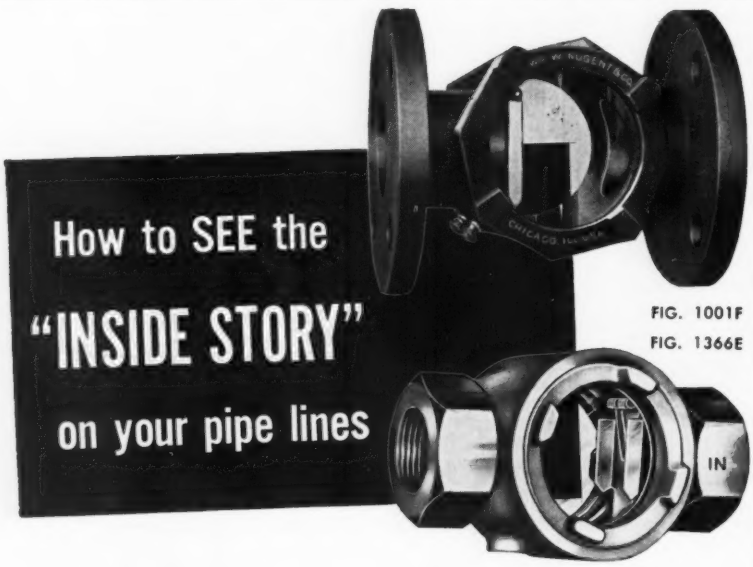
The Council guide also contains a list of "do's" and "don'ts" in the preparation of news releases.

The ASCE manual is more of a "how to" guide, giving the mechanics of what to write about, how to prepare a release, and who to send it to. It includes examples of typical news releases.

More Togetherness

The American Society of Civil Engineers, at its recent Reno meeting, voted, "to authorize ASCE participation in the joint committee with the American Institute of Consulting Engineers and the Consulting Engineers Council, which joint committee would have the purpose of centralizing policies and actions relating to the private practice of engineering and would report to the Board of Direction through the Executive Committee of the Department of Conditions of Practice."

Secretary Wisely of ASCE has now written the letters inviting the Institute and the Council to participate in this joint committee. It is expected that both the Council and the Institute will react favorably to this ASCE suggestion. ▲▲



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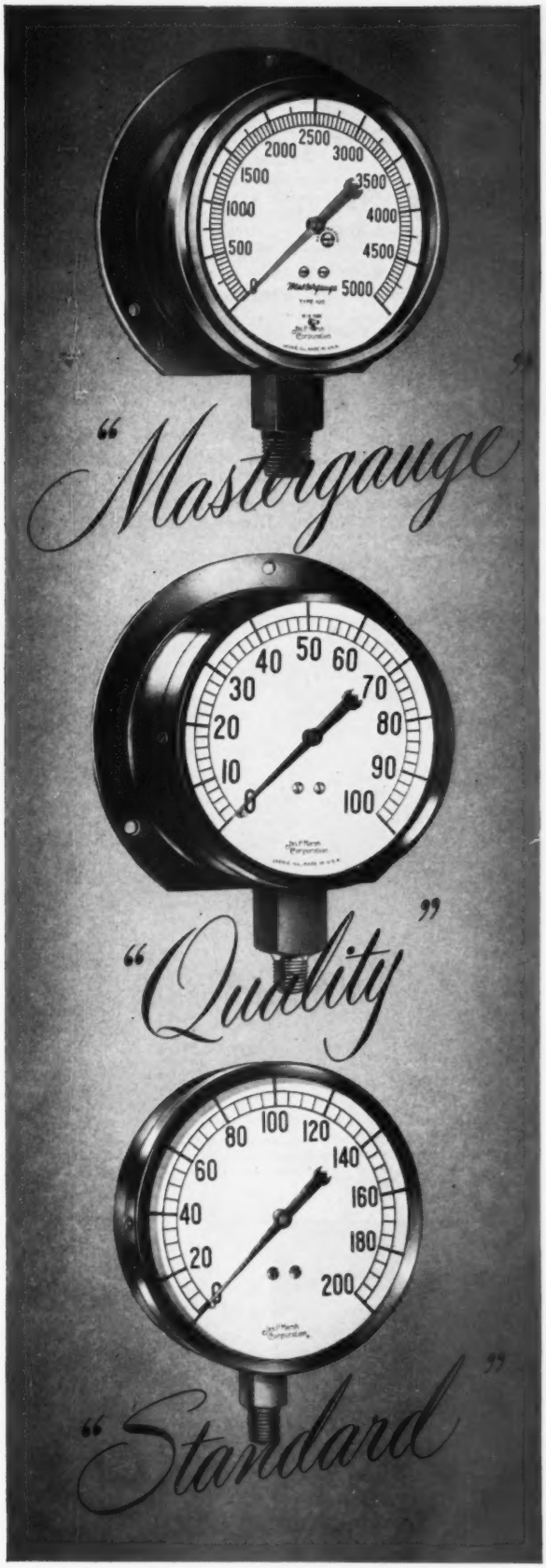

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JOB REPORT: *NELSON Stud Shear Connectors in Composite Construction*

COMPOSITE *STEEL-CONCRETE* CONSTRUCTION*

...in new Syracuse Parish Center

"On this project, long span floor construction was necessary to conform with column-free room areas. Composite Construction was used because it effected reductions in steel tonnage, depth of construction and resulting building costs." So says Thomas M. Farmer, Consulting Structural Engineer on the Most Holy Rosary Parish Center, Syracuse, New York.

Although, Composite Construction for buildings is relatively new (it has been employed in bridge construction for over three decades), more and more engineers are using it to gain these economies and advantages over non-composite construction... *shallower beams,* to meet equal load requirements • *reduced over-all cubage,* economies in materials • *longer spans,* greater load-carrying capacity per-pound-of-steel • *wider spacings of columns,* more unobstructed floor space.

**A steel and concrete composite beam is made up of three essential elements: A steel beam, a reinforced concrete slab, and shear connectors. Horizontal shear is transferred to the beam through the shear devices which join the slab to the beam in such a way as to cause the concrete and steel elements to act as a unit.*

Call in your local Nelson field representative, or write for "The Case for Composite Construction", Nelson Stud Welding Division, GREGORY INDUSTRIES, INC., Dept. 14, Lorain, Ohio.

MOST HOLY ROSARY PARISH CENTER, Syracuse, N.Y.—**Architects:** Pederson, Hueber and Hares, Architects—Glavin, Landscape Architect • **Consulting Structural Engineer:** Thomas M. Farmer • **General Contractor:** Gallagher and Vault, Inc. • **Structural Steel Fabricator:** Empire Structural Steel Fabricators, Inc. • **Steel Erector:** Bornhurst, Inc.

NELSON Stud Shear Connectors *are approved by the AASHO for bridge construction.*

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Reporting

The New Projects

DC Insurance Building Finally Completed

One of the most interesting aspects of the new Government Employees Insurance Company building in Chevy Chase, Maryland was the six-month interruption of construction while authorities debated the location of U. S. Interstate Route 240. An alternate location finally was selected for the road. Meanwhile, because of the rapid growth of the company, it was decided to increase the size of the new building from 202,000 to 276,000 square feet. By concentrating on the new foundations when work was resumed, it was possible to make one building operation out of the original building plus the added building at a considerable cost saving to the company.

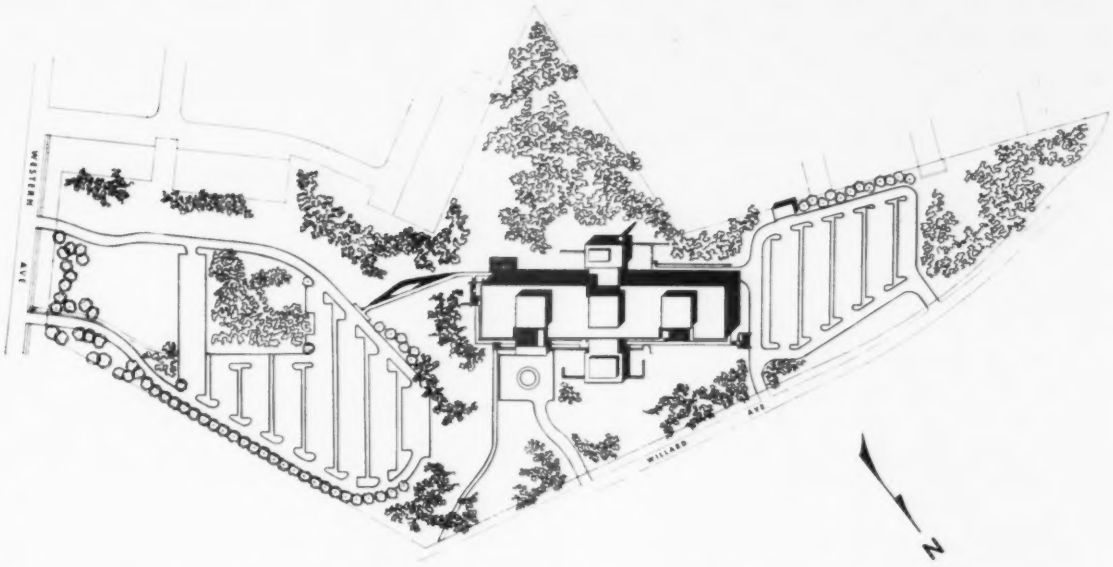
Firms participating in the design and construction of the new building were Vincent G. Kling, architect; Turner Construction Company, general contractor; A. E. D'Ambly, mechanical and electrical engineers; McCormick, Taylor, Associates, structural engineers; Ebasco Services, space planning consultants; and Arthur W. Dana, food service design consultant.

The reinforced concrete building has four long floors and a one-story cafeteria wing. The recessed tower in the center is one of three cores where stairs, restrooms, and mechanical equipment are concentrated. The building recently received the Oliver Owen Kuhn Cup as the outstanding building erected in Montgomery County in 1959.

World Bank Loan to Colombia

The thermal power plant at Yumbo in Colombia which supplies electric power to the Cauca Valley and the City of Cali was constructed and expanded with the financial assistance of two World Bank loans made in 1955 and 1958. In May of 1960 the World Bank loaned an additional $25 million for

Continued on page 176



Government Employees Insurance Co. building was completed after six months delay due to highway relocation hassle.

Aerial surveys covering some 11,000 square miles of the area were made for the Kariba project by Fairey Air Surveys Ltd. The survey was extremely accurate as shown by checks from ground based surveys made six years after the original data was gathered. These before-and-after shots give some idea of the magnitude of the project. Note the clearly defined townsites and major roads which were required. Because of the awkwardness of the site an extensive transport service had to be created, requiring 150 miles of heavy duty access roads on and around the site.

Kariba Dam Generators on Load

Kariba Dam is finished. Behind it the waters of the Zambesi River are backing up for some 175 miles to form a 30-mile wide lake – the largest ever made by man. About 50,000 Batonka tribesmen have been moved from the 2000 square mile lake site, as have many of the wild animals. But tribesmen and animals alike were reluctant to move, and even the River went out of its way to thwart the contractors. In spite of these obstacles, the second generator went on load on May 1 – precisely according to schedule.

The $225 million required for the first stage of the Kariba project came from many sources, including $80 million from the World Bank. An estimated $91 million remains to be financed for the second stage. Six generators will be on load by 1962, each rated at 100 MW. They will be located in an underground station which is 460-ft long, 80-ft wide, and 120-ft high. Two, 200-ton gantry cranes are installed to handle the 350-ton rotors of each alternator.

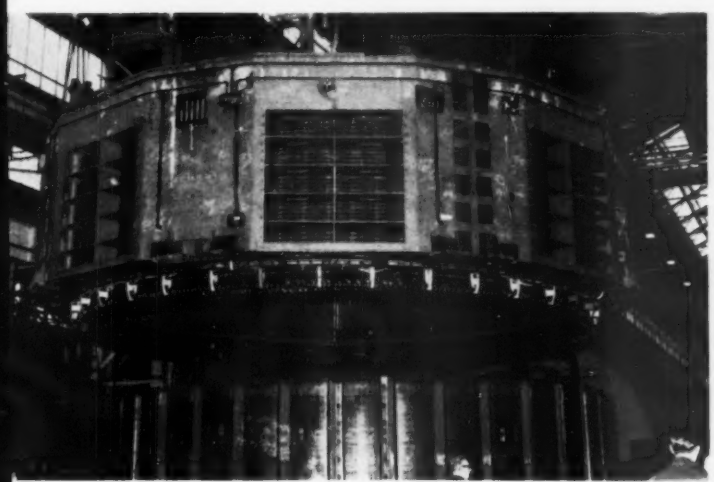
The Dam itself is a pure arch containing 1.4 million cubic yards of concrete. It rises 420 feet above the river bed and supports a 1900-ft long highway on its crest. There are six spillway gates, each 30 feet square, in the middle of the dam face.

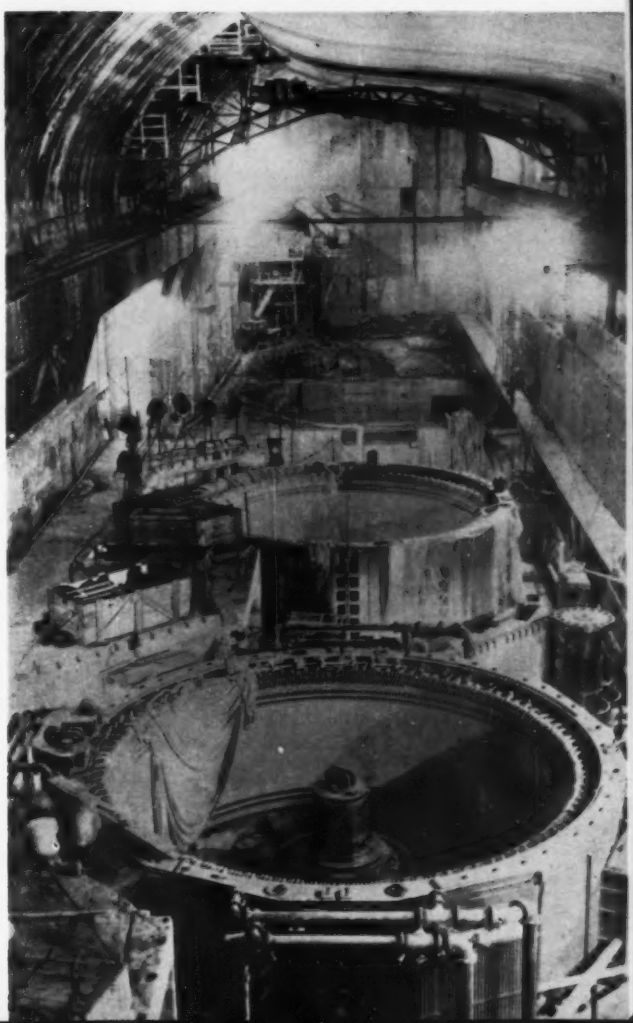
The project is a creature of many consulting firms. The joint group of Gibb, Coyne, Sogei, Limited handled the design and supervision of construction on the giant complex, with Sir Alexander Gibb and Partners (Africa) Limited designing harbors on the lake, and Merz and McLellan of London the consultants for the Rhodesian Federal Power Board.

The pure arch dam at Kariba is one of almost 100 designed by M. Andre Coyne. The 420-ft high, 80-ft thick structure contains 1.4 million cubic yards of concrete. Behind it is growing a 2000 square mile lake, with more than four times the capacity of Lake Mead at Hoover Dam on the Colorado. The tremendous weight of water is expected to cause the earth's crust to sag, and plans have been made for making accurate measurements. Minor earthquakes also may occur in the region.

The south bank underground power station turbine hall, with electric generators under construction. Installation of six units will be completed during 1962, well ahead of the originally planned schedule. Each of the six generators weighs 720 tons, is 40 feet in diameter, and will be coupled to a Francis type turbine.

Two, 200-ton gantry cranes had to be installed to handle the 350-ton rotor of each alternator. Here the stator is being lowered into position over the rotor during the assembly of one of the generators. First unit went on load at the end of 1959, and the second on May 1, 1960. Generators are rated at 100 MW each.





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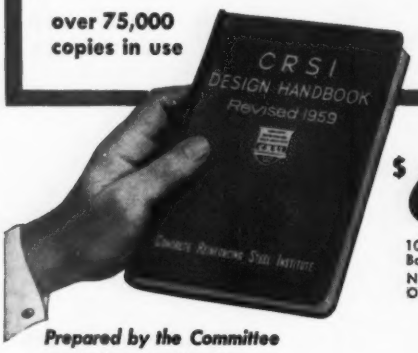

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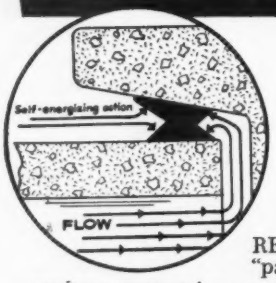

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Continued from page 173

the development of electric power in Colombia. The funds will be used to finance the foreign exchange cost of a third generator unit in the Yumbo plant, the construction of a hydroelectric plant at Calima, and expanding the transmission facilities in the Cauca Valley. Colombia has now received 16 loans from the World Bank, totaling $173.2 million.

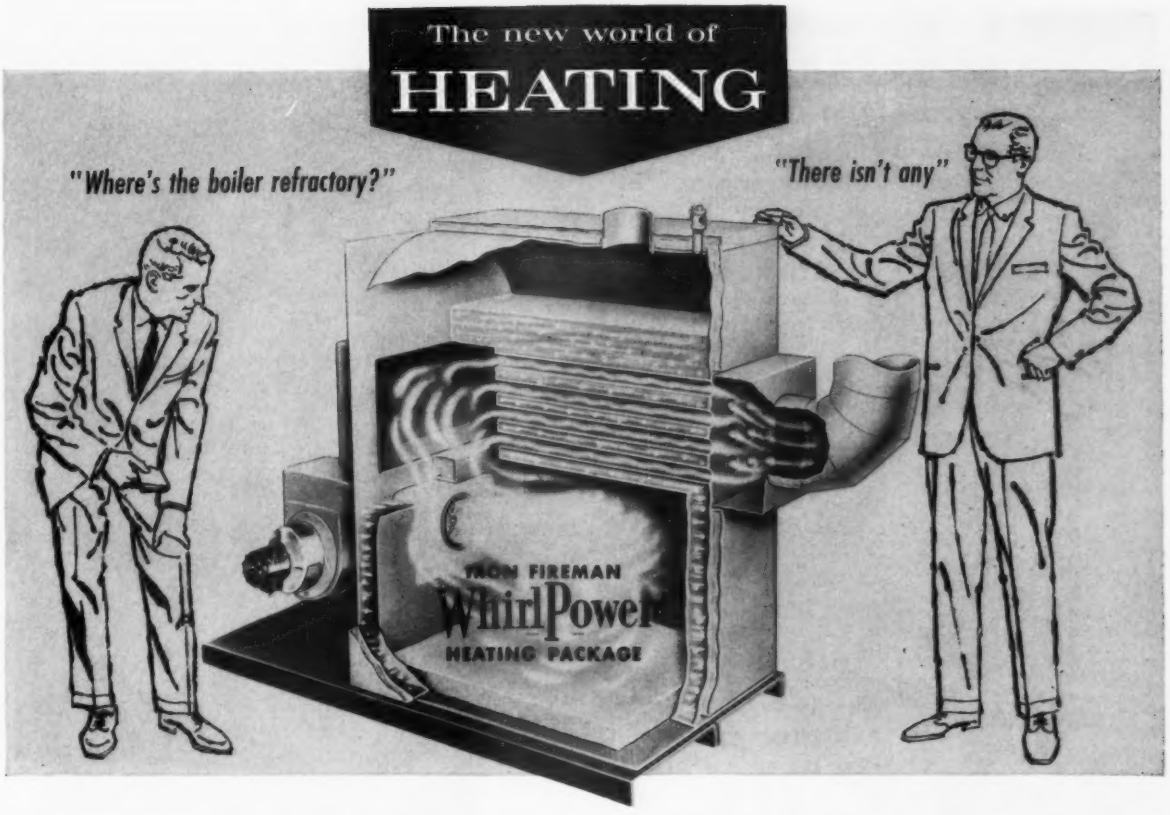
Consulting engineers for the Calima projects are an association of Gibbs & Hill, Inc.; Tippetts-Abbett-McCarthy-Stratton; and Olarte, Ospina, Arias & Payan, Ltda., of Bogota, Colombia. The three firms performed preliminary engineering and currently are preparing bid plans and specifications.

Australia Gets Its First Skyscraper

Construction is under way on the Australian Mutual Provident Society's 26-story head office. Rising to a height of 375 feet, the building will provide 500,000 square feet of floor area and cost approximately $12 million. As this is the first skyscraper ever built in Australia, it was felt by the Society and the Sydney architectural firm of Peddle, Thorp and Walker that the full benefit of U.S. experience with high buildings should be obtained. It was for that reason that the New York architectural firm of Kahn & Jacobs and the mechanical and electrical consulting firm of Slocum & Fuller were retained as over-all consultants in their respective spheres. The firm of John R. Wallace, North Sydney consulting engineer, has been retained in charge of over-all engineering, and the firm of Rankine & Hill, Sydney structural engineer, has been retained for structural design.

In addition to the difficulty of communication between Sydney and New York, many other interesting problems developed. After discussion with the local authorities in Sydney it finally was decided to use the American one-pipe sanitary drainage system rather than the British two-pipe system. Also, a stiff argument regarding the use of sprinklers throughout the building developed, because of the fact that the Sydney Fire Brigade had no experience with fire protection in high buildings. To solve the problem, complete data on fire protection requirements in every major modern city in the world was assembled and a modified form of sprinkling finally was agreed upon.

Much of the design of the special communications systems throughout the building will be left to the manufacturers and to the specialty suppliers. However, detailed evaluations of the various systems will be required. It is also standard practice in Australia to install emergency motor generator sets capable of handling a high proportion of the total building load. This called for a carefully inte-



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Whether firing oil or gas, the entire air supply is introduced through the firing port, under forced draft, into a sealed combustion chamber. Fuel and air are combined within a firing head of new and unique design. Since firebox pressure remains constant (unaffected by the uncertainties of natural draft) the air volume can be as accurately metered as the fuel supply.

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Iron Fireman WhirlPower combustion eliminates many causes of service. Most service calls result from sooted flues, fouled electrodes, dirty combustion controls, or by carbon-clogged nozzles, baked by the reflected heat of hot refractory. The considerable cost of refractory maintenance is also eliminated. With a high resistance to the passage of air through burner and boiler, and no draft-producing stack, standby losses are reduced to a minimum. This, plus high combustion efficiency, results in substantial fuel savings.

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Forced draft and sealed combustion makes a high stack unnecessary. Only an exhaust vent or stub stack is needed, and this can be a third smaller than the usual flue diameter.

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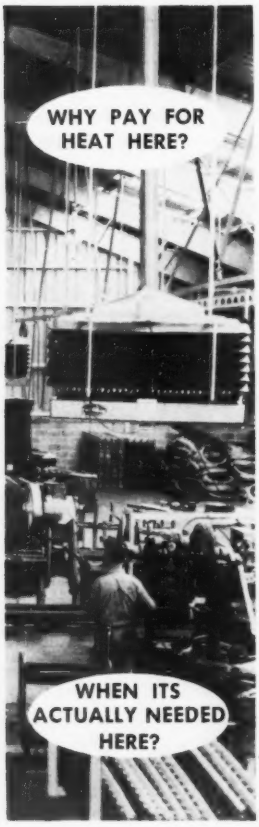

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grated electrical supply design between the utility and the building generators. Switchgear arrangements were carefully checked and proper interconnection arranged.

Actual construction of the building commenced in December 1959, and although much remains to be done, the combination of Australian techniques and American experiences has been both interesting and exceedingly successful.

Pasadena's Tallest New Building

Completion of the $1,250,000 Independence Life Insurance Company of America building in Pasadena, California, was announced recently. Faced

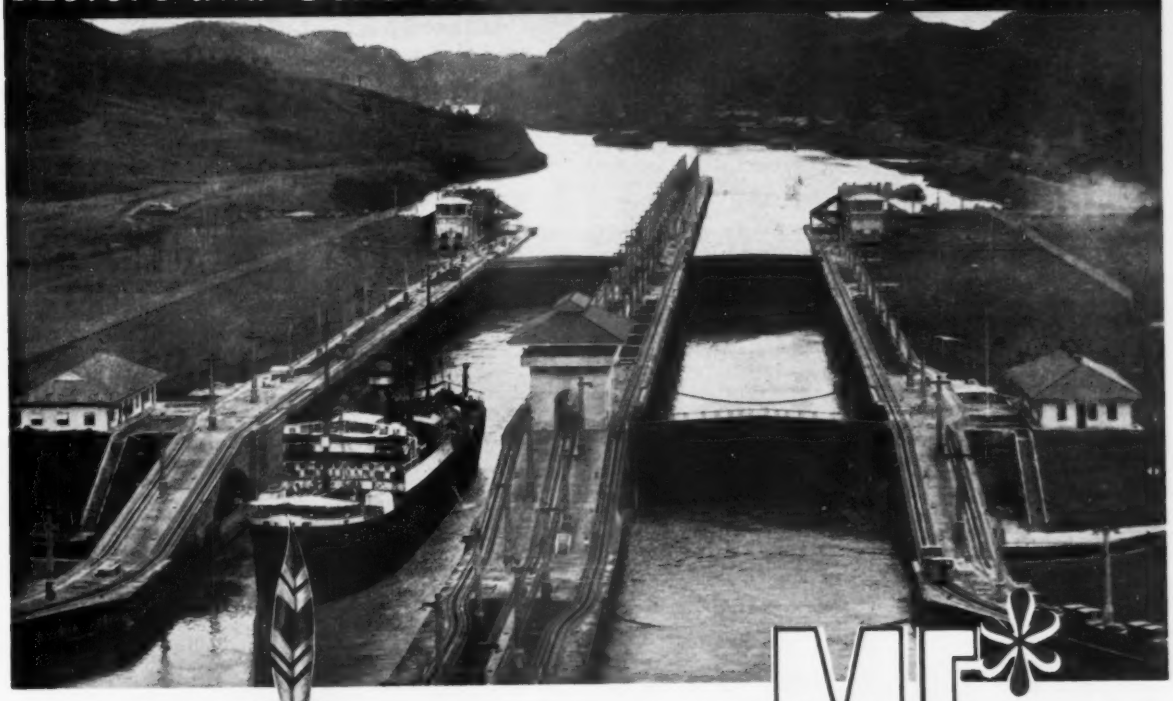
Pasadena's newest tall building was built for the Independent Life Insurance Company of America.

on two sides by dramatic gold anodized aluminum sunscreens, the new building is the tallest one erected in Pasadena in recent years.

Of contemporary design, the building provides five stories, with exterior walls rising a full six stories to shield the view of the equipment penthouses. The 38,000 sq ft structure was planned, designed, and engineered by Welton Becket and Associates, architectural and engineering firm of Los Angeles, California.

The aluminum grill, specially designed by the architects, is patterned by tall colonnades of vertical aluminum strips that rise the height of the building above the ground floor. The grill itself is perforated and textured to create a basketweave

Motors and Generators...that's our Business!



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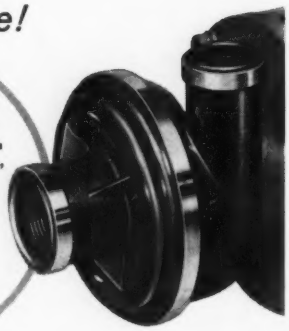

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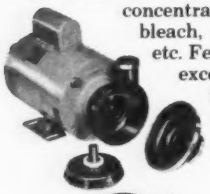

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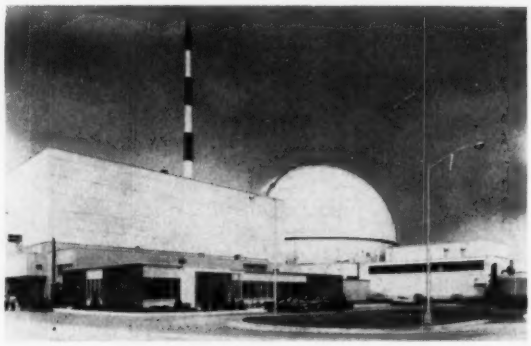

The 180,000 kw Dresden plant, near Chicago, is the largest privately financed all-nuclear plant in the U. S.

The 180,000 kw Dresden plant, located southwest of Chicago, is the largest privately financed, all-nuclear power station in the country. The facility was designed and built by General Electric Company, with Bechtel Corporation as engineers-constructors. Full scale operation of the plant began in mid-April.

Yugoslav Firm Gets Aswan Dam Contract

The consulting engineering firm Geoistrazivanje, of Zabreg, in Yugoslavia, has won a contract for the rehabilitation of the old Aswan Dam on the Nile River. The value of the work to be done will amount to about $1.7 million. A team of about 60 Yugoslav experts will be engaged on the job which will involve concrete injection to prevent escape of water from the impounded storage lake. It is anticipated that the water level of the lake will rise about one meter, adding 400 million cubic meters to the present storage capacity of the dam. The Yugoslavian firm's experience in sealing the permeable limestone karst on the Peruca lake project in Yugoslavia will be invaluable on the project. ▲▲

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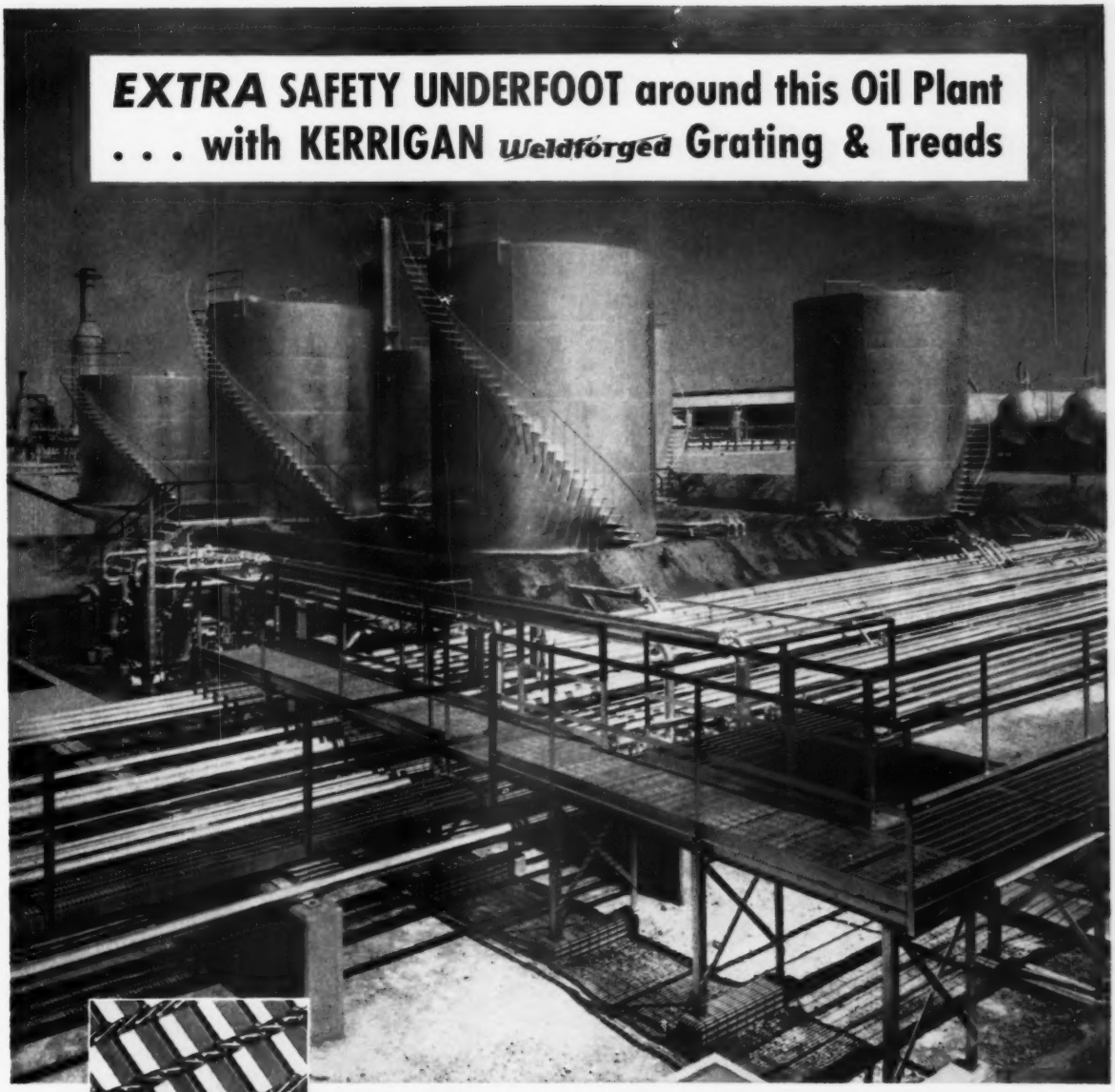

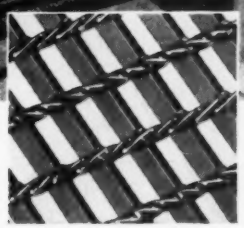

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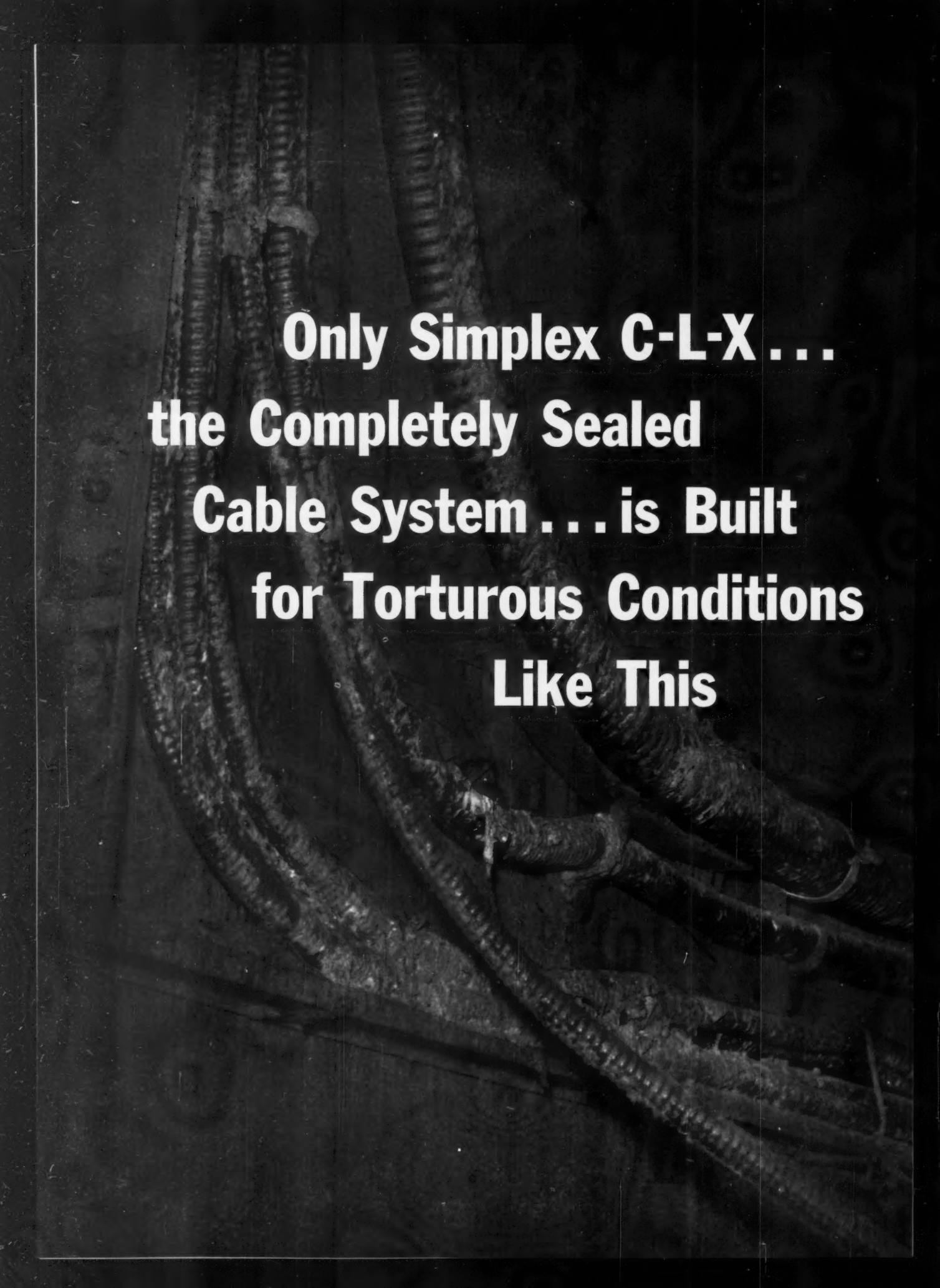
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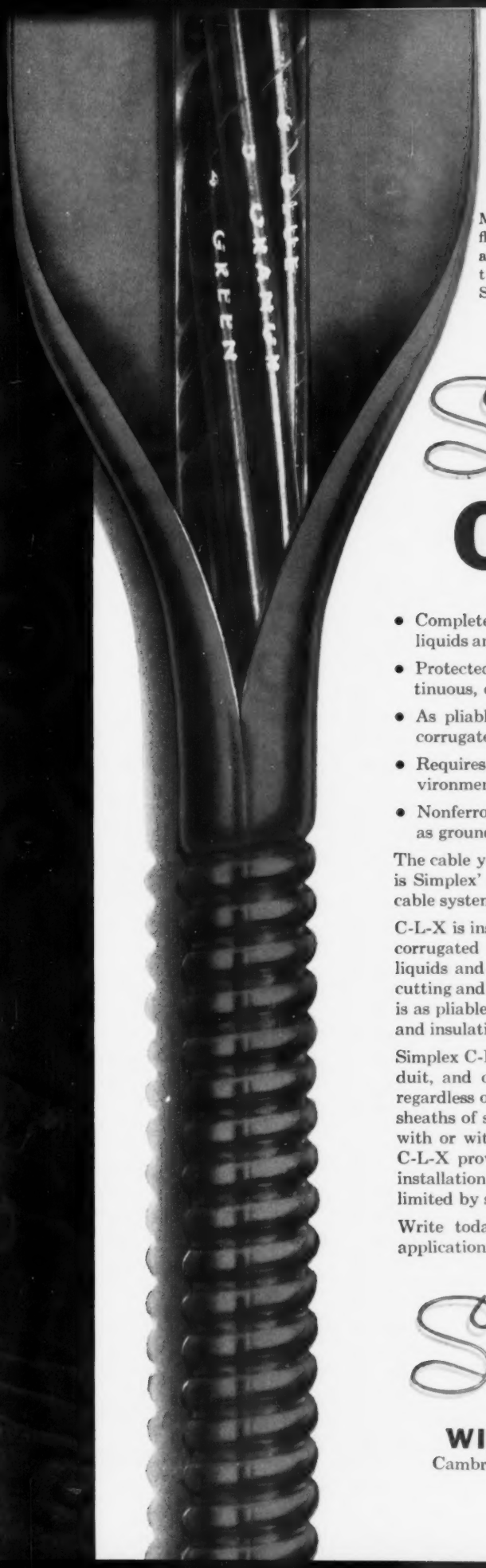

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Metal, in the form of a continuous flat strip, is formed into a welded tube around the insulated cable. The metal tube is then corrugated to form Simplex C-L-X.

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C-L-X

- Completely sealed to prevent penetration of liquids and gases.
- Protected against mechanical damage by a continuous, corrugated metallic sheath.
- As pliable as unsheathed cable because of its corrugated design.
- Requires no separate duct or conduit in any environment.
- Nonferrous sheaths can be designed to function as grounds or shielding.

The cable you see here is *not* interlocked armor. It is Simplex' new C-L-X . . . the completely sealed cable system.

C-L-X is insulated cable enclosed in a continuous corrugated metallic sheath. It is impervious to liquids and gases, is highly resistant to crushing, cutting and other forms of mechanical damage, and is as pliable as unsheathed cable of the same size and insulating compound.

Simplex C-L-X requires no separate duct or conduit, and can be installed in a continuous run regardless of the number of bends. Available with sheaths of steel, aluminum, copper or bronze, and with or without outer plastic jacketing, Simplex C-L-X provides the ideal solution for almost any installation, particularly those in which cable life is limited by severe ambient conditions.

Write today for illustrated brochure containing application and engineering information.

Simplex

WIRE & CABLE CO.

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For on-the-line package weight control — W-C CHECK-WEIGHING SYSTEMS

Whatever your requirements for production check-weighing of packaged materials, W-C can supply a job-engineered system to meet them. Systems can be automatic or manual; can weigh in motion or stop-and-go; can segregate packages according to specific zones of under- or overweight, or according to a single pre-selected tolerance. They can provide practically any type of readout you want, and can be readily integrated with tape-fed, punched-card and other types of data handling systems.

Surprisingly, such job-engineered systems can be delivered at a most realistic cost—probably less than you'd expect. The reason why is a simple one: pre-engineered components, unitized design. There is no speculation or experimentation; W-C systems are designed on the very practical basis of service-proven, standardized components.

Typical applications include: Checking weight of tire treads as extruded . . . checking container weights after automatic filling . . . checking multi-unit package weights.

Write for new Bulletin 50

W&C **WEIGHING & CONTROLS, INC.**
Div. of CompuDyne Corp.

E. County Line Road • Hatboro 11, Pa.

Men in Engineering

Dalton Dalton Associates, architects and engineers of Cleveland, Ohio, announce the appointment of Eugene B. Fisher, Jr., architect, as director of hospital planning and Don M. Hisaka, architect, as director of architectural design.

Harold Bateson and Gordon Bronson have been admitted as partners of the firm of Charles A. Maguire & Associates, consulting engineers of Providence, Rhode Island and Boston, Massachusetts. It has also been announced that Grant H. Potter has withdrawn as a partner of the firm and will act as consultant to the partnership.

Edward J. Quirin, chairman of the board and president, Frederic R. Harris, Inc., announces the firm's move to a new building at 144 East 44th Street, New York City, which has been named after the company. Building commemorates the name of the late Rear Admiral Frederic R. Harris, distinguished Naval and civil engineering officer, inventor and consulting engineer, who founded the firm in 1927.

Vito V. Cerami has been appointed senior consultant in the firm of Michael J. Kodaras, consultants in acoustics, New York, New York. Cerami has been actively engaged in the field of mechanical acoustics for the past 11 years as chief engineer and general manager of T. R. Finn & Company, specialists in industrial and military vibration isolation products. As a member of the Kodaras organization, he will specialize in the acoustical analysis of air conditioning and other mechanical systems.

Melbourne A. Forrest has been named a vice president by Burns and Roe, Inc., New York City engineers and constructors. He will continue to be responsible for the company's operations in power, nuclear, and industrial facilities, in addition to defense and aeronautical projects.

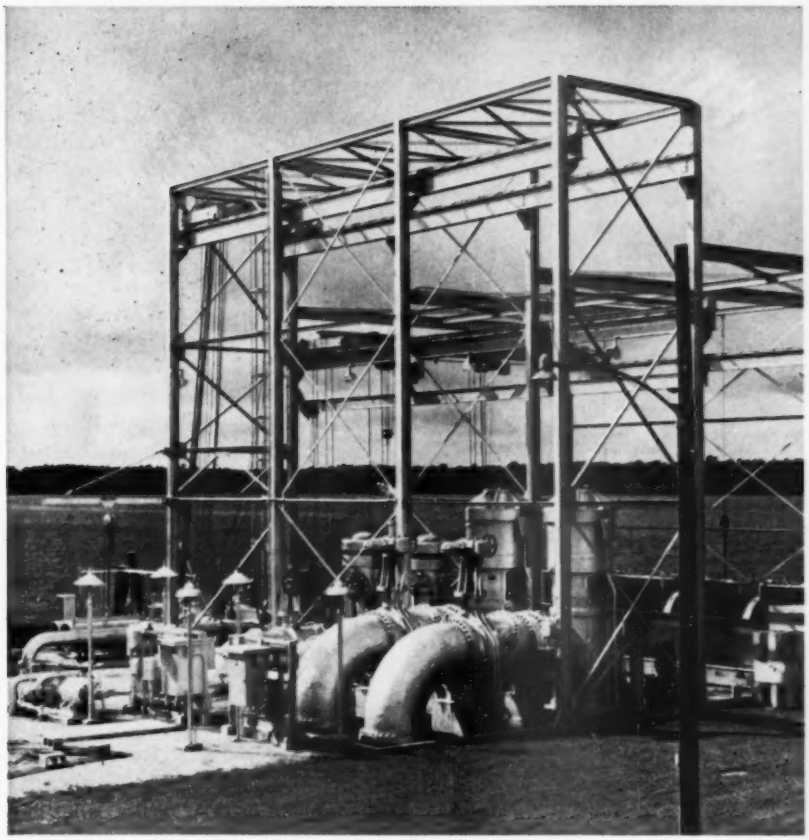
FORREST MERCADO

Alfred Mercado has been appointed director of planning of Lublin, McGaughy & Associates, architects and consulting engineers, of Washington, D. C. For the past two years, Mercado has directed the firm's planning work in Europe, North Africa, and the Middle East. With the completion of these assignments, Mercado will now direct urban renewal programs, metropolitan area studies, and master planning activities for the firm in the United States.

Two recent appointments have been announced by The Hinchman Corporation, consulting engi-

News about

B.F.Goodrich Chemical *raw materials*



Florida Power & Light Company uses anode racks made of Geon vinyl pipe. Fabricated by F P & L plant personnel at this job. B.F.Goodrich Chemical Company supplies the rigid Geon vinyl. These photos show intake structure at Palatka plant on St. John River, one of many places anode racks of Geon are used.

FP&L fights underwater corrosion with anode racks of rigid GEON

Underwater steel structures corrode when they are attacked by galvanic currents. Florida Power & Light engineers solve the problem two ways. They reduce effect of galvanic currents with an opposing voltage and they suspend anodes of graphite to bear the brunt of any continuing flow. These anodes rest in frames made of rigid Geon pipe.

Vertical side frames are 2″ Geon pipe and trays are open sections of 5″ pipe. The only effect on the racks of Geon is the marine growth shown in the photo at upper right. This growth is easily washed off, as photo at lower right shows.

Here's another example of the way Geon vinyl can solve corrosion problems for utilities. As pipe, as conduit, or as coatings, you'll find Geon vinyl is often the answer to your corrosion problems. For more information, write Dept. GI-4, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon VINYLS

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

neers of Detroit. Fred A. Compton, formerly vice president of The Detroit Edison Company, has been appointed a director of the firm and Edward T. Vincent, professor, University of Michigan, has been named associate and consultant.

The Fluor Corporation, Ltd. has announced the re-assignment of two top executives, Ernest Moncrief and James P. Wiseman, Moncrief, formerly vice president of the company's Mid Continent Division in Houston, Texas, was appointed to the newly-created post of vice president-coordinator of foreign operations and affiliates. Wiseman, formerly president of Fluor Products Company, was moved to Moncrief's former position. In his new role, Moncrief will coordinate the activities of parent company subsidiaries and affiliates, including: The Fluor Corporation of Canada, Ltd.; Fluor Engineering & Construction Company, Ltd. of London, England; Fluor-Schuytvlot, N.V. of Haarlem, Holland; Singmaster & Breyer, Inc.; and H. G. Acres Company, Ltd. Moncrief will operate from Fluor's headquarters in Los Angeles.

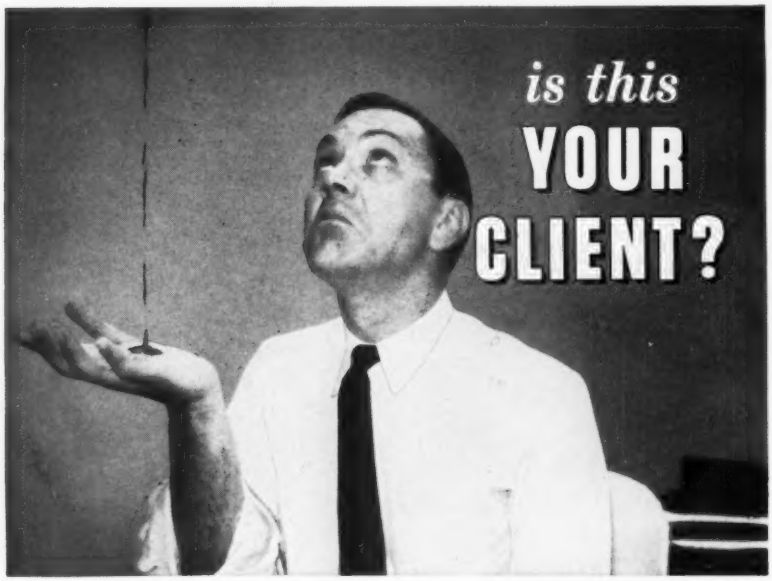
J. Terence Gregg has been appointed chief engineer and a director of Morrison, Hershfield, Millman and Huggins, Limited, consulting engineers, Toronto, Ontario. Gregg formerly was supervising bridge engineer for the Foundation Engineering Corporation Limited, responsible for design work in connection with numerous bridge and highway projects in the Province of Ontario, including the Burlington Skyway, the Don Valley Parkway, the Rainy Lake Causeway, and most recently, the new Homer Bridge at St. Catharines.

GREGG PETTITT

J. S. Pettitt, Jr. has been appointed assistant chief draftsman of the architectural department of Albert Kahn Associated Architects and Engineers, Inc., Detroit.

A new firm, Westenhoff & Novick, Inc., has been formed for the practice of structural, foundation, and civil engineering. Principals are Alphonse M. Westenhoff and David Novick. Office address is 234 South Wabash Avenue, Chicago, Illinois.

C. Kenneth Kolstad, P.E. announces the opening of an office for electrical surveys, investigations, analysis, and design at 612 South Tejon Street, Colorado Springs, Colorado. ▲▲



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the ballast that can't drip compound!

The new Jefferson DRI-LOK ballast ends the danger of compound drip with an entirely new thermo-setting material—a dry, solid-fill material so chemically and physically stable, it cannot combine or react with any other material in the ballast. And it cannot soften or liquefy under any operation condition—for the life of the ballast.

The extreme stability of the DRI-LOK ballast also assures consistently uniform operation. For the first time, physical properties of the fill material can be closely controlled and accurately reproduced. Structural and performance variations are minimal in the Jefferson DRI-LOK ballast, allowing unprecedented uniformity—whether your installation requires two ballasts, or two hundred.

Write today for complete details about the new *blue* ballast—the most significant *client-pleasing* development in ballast design since the introduction of fluorescent lighting!

Jefferson DRI-LOK
The New Blue FLUORESCENT BALLAST
Jefferson Electric Company • Bellwood, Illinois

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PROTECT thermal insulation with foster PRODUCTS

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mastics	60-25/26	C. I. MASTICS	Asphalt vapor-barrier weathercoats	M-2-B
	*60-30N/60N	FIRE-RESISTIVE MASTICS	Non-asphaltic with nonflammable solvent for boiler walls and breechings	M-2-A, B
	60-80	SAFETEE MASTIC	UL-listed asphalt "breather" coating for ducts and breechings	M-2-B
	90-07	H. I. MASTIC	Fibrated asphalt "breather" weathercoating	M-2-B
	60-99	HILASTIC	Flexible asphalt weathercoat of HiLastic system	M-3-D
adhesives	*81-42W	LAGFAS	Economical adhesive for lagging canvas on piping	A-2-A
flashings	30-46	INSULATION SEALER	Flexible sealer for flashing insulation	F-2-A
	60-25	C. I. MASTIC	For sealing laps of vapor-barrier jacketing	F-2-A
coatings		*LAGTONE	Flexible fire-resistive coatings in white and colors	C-2-A, B
	*30-36	SEALFAS	Light-colored fire-resistive, abrasion-resistant lagging and coating	C-2-A

*** THESE PRODUCTS (60/30N, 60/60N, 81/42W, 30/36, LAGTONE) MEET THE FLAME SPREAD REQUIREMENTS OF GENERAL SERVICES ADMINISTRATION WHEN TESTED IN ACCORDANCE WITH INT. FED. STD. NO. 00136 (COM-N.B.S.) *60/30, 60/60, 60/80 ARE ALSO LISTED BY UNDERWRITERS' LABORATORIES.***

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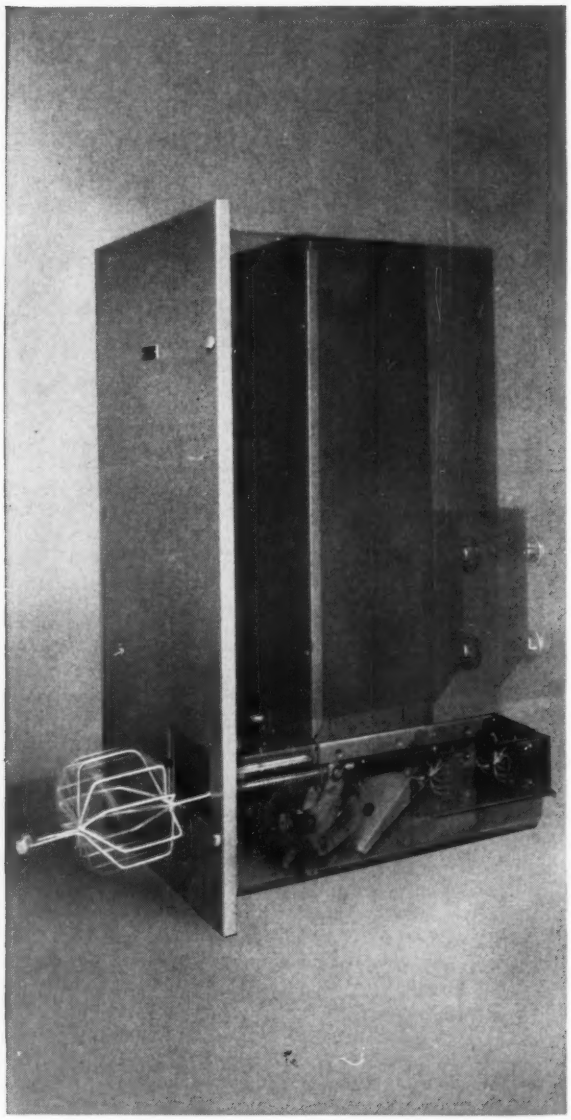
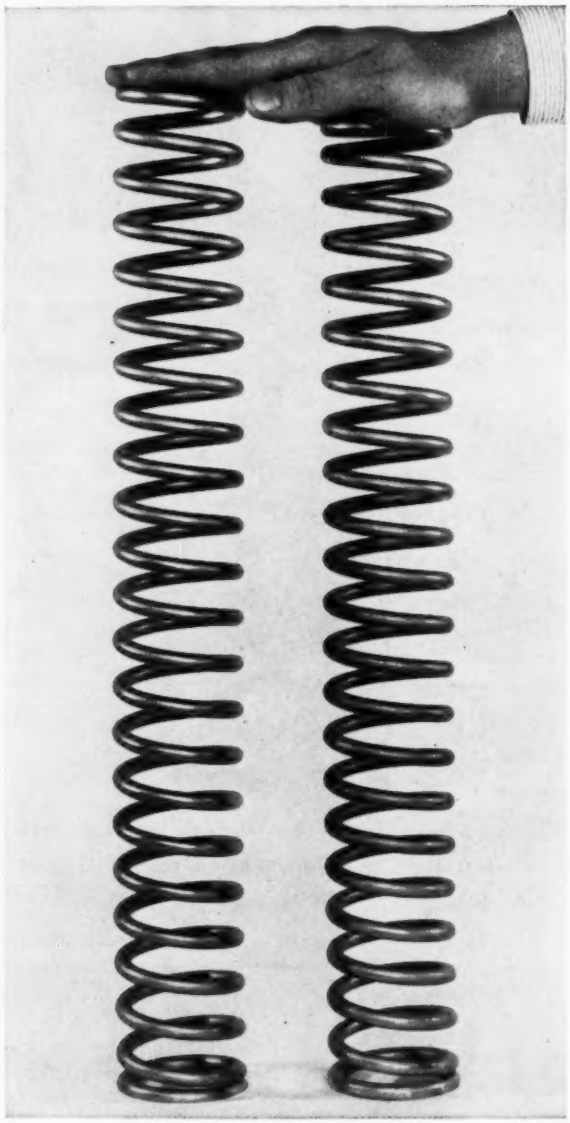
P-4 Bulletin _____

What New Metal-

Has closed-door drawout...



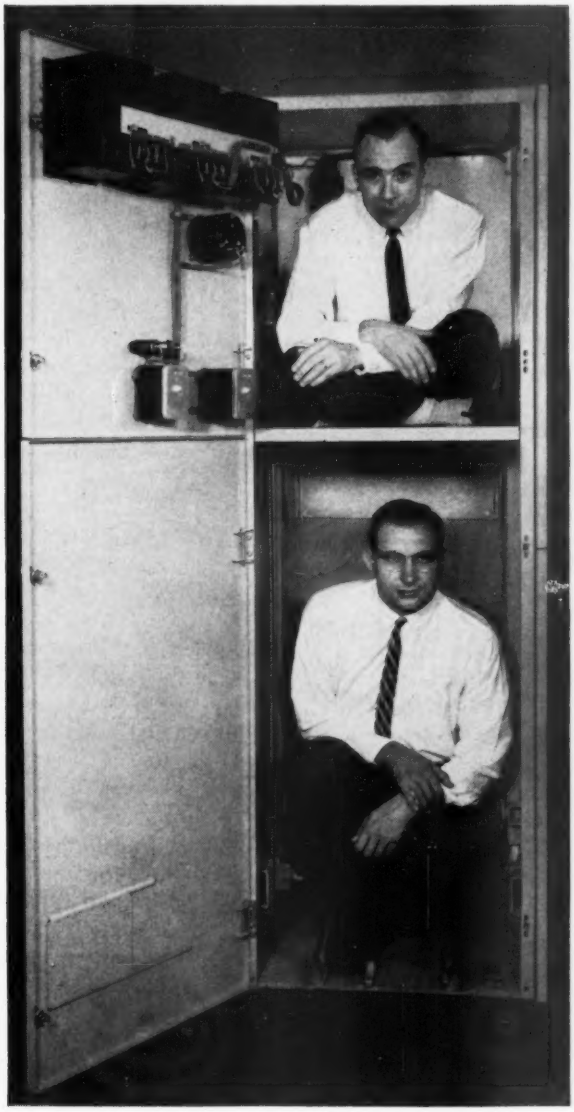
Stored energy as standard...



For complete answer, send for new illustrated Bulletin 2801-2A. And ask to see sound strip film that shows you every detail in only 18 minutes. Can be shown to you singly or to your group. Contact your nearby I-T-E sales office. Or write I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Phila. 30, Pa.

Clad Switchgear...

More elbow room inside...



Yet fits in tighter spaces?

I-T-E CIRCUIT BREAKER COMPANY

PATHWAYS OF A PIONEER

ILLCO-WAY DESIGNERS AND BUILDERS

MODERN EQUIPMENT FOR ionXchange

1954 Unprecedented when installed, this huge (5000 gpm) automatic mixed-bed ionXchanger is still the world's largest (in continuous flow rate).

This power plant, where the big ion-Xchanger shown above is installed, furnishes steam for much of mid-town Manhattan.

Blazing New Paths in De-I Developments

IWT originated the Mixed-Bed De-Ionizer in 1949, and *automatic* versions of this high-performance equipment have been in use since 1953. The big one shown above delivers an unbelievable volume of water of "fantastic purity" (to quote the operators). For example, soluble silica in the feed water for the high-pressure boilers runs .01 ppm or less, and other impurities are unmeasurable. Such performance is in accordance with design specifications and proposal promises. Such successful pioneering has paid off handsomely for later purchasers of IWT equipment.

THIS EXPERIENCE CAN MEAN A LOT TO YOU

If you need pure water for high-pressure boiler make-up or process use, or if you are considering the use of ion-exchange for purification or concentration of chemical products, be sure to take advantage of IWT's 22 years of experience and vast array of specialized knowledge. *Call your IWT representative.*

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The High Spots

THERE would be no basis at this time for ordering installation of barriers along the medial strip of the Pennsylvania Turnpike as a safety precaution, it was declared by Franklin V. Summers, director of operations for the pike. His views were expressed in commenting on a letter from Dr. E. J. Kowalewski of Rothsville, Lancaster County, who also wrote Governor Lawrence urging that barriers be installed.

"We have had this matter under consideration for three years and our engineering staff is constantly examining ways to improve safety on the turnpike to satisfy the needs of all motorists," Summers said. Noting that guard rails at the center of the toll superhighway have been erected along 45 miles considered to be "danger areas," Summers said the turnpike has found that twice as many persons were killed driving in these areas than was the case before the guard rails were erected.

Maryland Reviews Contracts

In an effort to prevent scandals that have shaken highway programs in some other states, John B. Funk, chairman-director of the Maryland State Roads Commission, announced that a firm of private consultants has been asked to thoroughly review the administration of highway contracts. "We think our procedures of checks and balances are good," Funk said, "but we want to make certain."

Stressing that he was not aiming at a specific target, except the general one of making certain that there was no avenue open to abuse in the Maryland program, Funk said the review would be performed by Highway Management Associates, of Madison, Wisconsin.

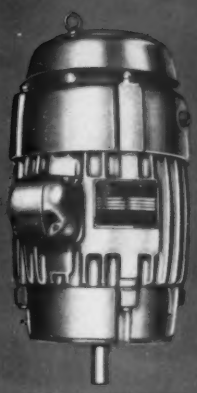
The survey is a direct result of formal recommendations made by the American Association of State Highway Officials, which expressed concern that any further abuses by states would result in greater Federal control of the Federal-aid highway program. Funk said reviews were under way in several states as a result of irregularities recently brought to light in the administration of Federal funds near Tulsa, Oklahoma. That case was investigated recently by a Congressional subcommittee.

Maine Road Maintenance

A report by the consulting firm of Ebasco Services, Inc., following a 10-month study, held that the Maine Highway Maintenance Division needs more formal organization of its road crews and a tighter chain of command. General maintenance – all kinds of road upkeep except snow and ice removal and tarring – suffers in the state from lack of coordinated effort, according to the report, which said that otherwise the division gets good results.

The Maine Highway Commission, the consultants said, "is far from being an inefficient organization; indeed, the attitude of its personnel and quality of their work had much to do with the successful preparation of this report." Although approving the handling of snow and ice control, tarring, and state-aid construction work, the report said: "There are far too many roads presently on the state-aid system which have no legitimate right to be there. State-aid designations were previously awarded with far too free a hand and there was not adequate control over the quality of state-aid construction. As a result, the state is saddled with the maintenance of far more mileage than it should legitimately maintain." ▲▲

TOTALLY-ENCLOSED*
RIGHT-ANGLE WORM-GEAR
SYNCROGEAR MOTORS



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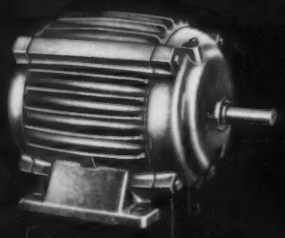
UNIMOUNT VERTICAL
SOLID SHAFT MOTORS



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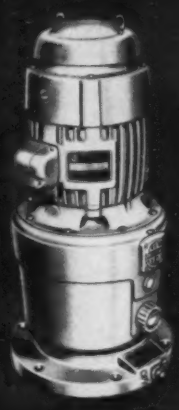
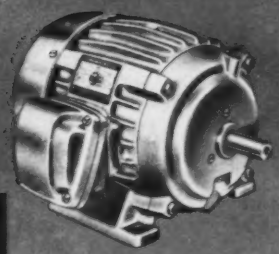
FANLESS TYPE
HORIZONTAL MOTORS



total protection *in every direction*



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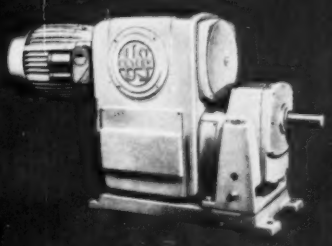
HORIZONTAL MOTORS



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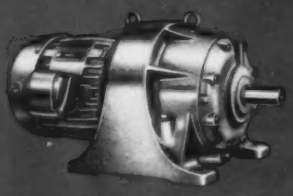
V-BELT DRIVE MOTORS



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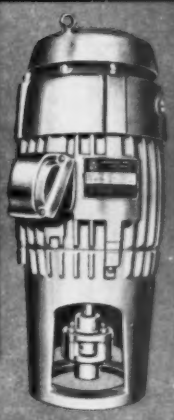
DOUBLE REDUCTION
SYNCROGEAR MOTORS



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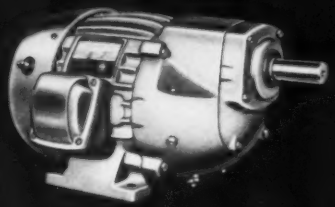
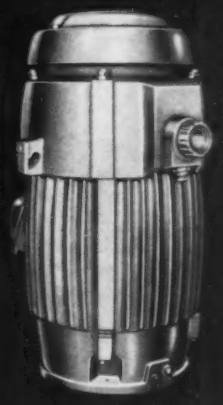
UNIBASE VERTICAL
SOLID SHAFT
PUMP MOTORS



TOTALLY-ENCLOSED*
SINGLE REDUCTION
SYNCROGEAR MOTORS



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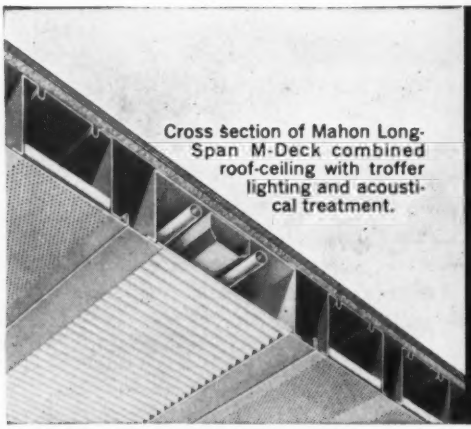
MAHON MULTI-USE LONG-SPAN M-DECKS...

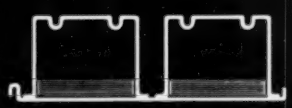


Cross section of Mahon Long-Span M-Deck combined roof-ceiling with troffer lighting and acoustical treatment.

MAHON LONG-SPAN M-DECK SECTIONS

SECTION M1-OB

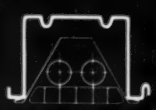
OPEN BEAM DEPTH 3", 4½", 6" or 7½"



PERFORATED AREA

SECTION M2SR (Acoustical)

CEL-BEAM DEPTH 1½", 3", 4½", 6" or 7½"



A NEW SECTION M1-OB (Trailer)

CEL-BEAM DEPTH 4½", 6" or 7½"

These are the standard M-Deck types now in manufacture by Mahon. Special-form sections can also be supplied.

. . . give you big structural advantages— even in small-building construction

Mahon Long-Span M-Decks furnish architects and engineers with roof sections of functional versatility that are ideal for any project, any budget—big or small. These steel sections provide a combined roof-deck system **and** finished ceiling that means real savings in specifying, erecting and service. Long-Span (truss-to-truss or wall-to-wall) M-Decks, quality made by Mahon, have a high strength-to-weight ratio for use as structural members and are supplied in metal gages and gage combinations for either flat or beamed ceilings. To suit your particular need, M-Decks are also available with or without recessed troffer lighting or acoustical treatment and for use as air-conducting or air-diffusing cells. Get the full story on M-Decks from your local Mahon representative, Sweet's Files or write for Catalog LSD-60.

1 Mahon Long-Span M-Deck was meaningfully used in this "twin" facility at Livonia, Michigan. For the offices of contracting firm, Peter H. Acitelli, Inc., with its . . .

2 . . . attractive reception area, Mahon Long-Span M-Deck was used as structural members to span wall-to-wall, as a roof-deck system and also served as a . . .

3 . . . finished acoustical ceiling in offices—flat ceilings in shops of the R. V. Tool Co. as well. Architects: Wakely-Kushner Associates, St. Clair Shores, Michigan.

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- Aluminum or Steel Curtain Walls (in natural or colored metals)
- Rolling Steel Doors (Standard or Underwriters' labeled)
- Metalclad Fire Walls (Underwriters' rated)
- M-Floors (Steel Cellular Sub-Floors)
- Long Span M-Deck (Cellular or Open Beam)
- Steel Roof Deck
- Acoustical and Troffer Forms
- Acoustical Metal Walls, Partitions and Roof Decks
- Permanent Concrete Floor Forms

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- Steel Fabrication-Weldments
- Geodesic Domes-Fabrication and Erection

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THE R. C. MAHON COMPANY

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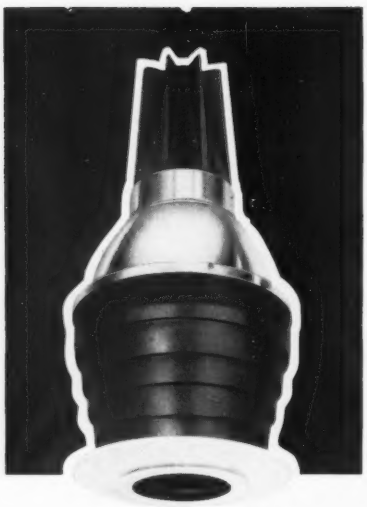
Speeding American Construction with Metal Building Products, Fabricated Equipment and Erection Services

MAHON



48-1000 line
the high ceiling
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BOOKS

Parallel Reading for Consulting Engineers

The American Civil Engineer — Origins and Conflict, by Daniel H. Calhoun; distributed by the Harvard University Press, Cambridge, Mass.; $5.50.

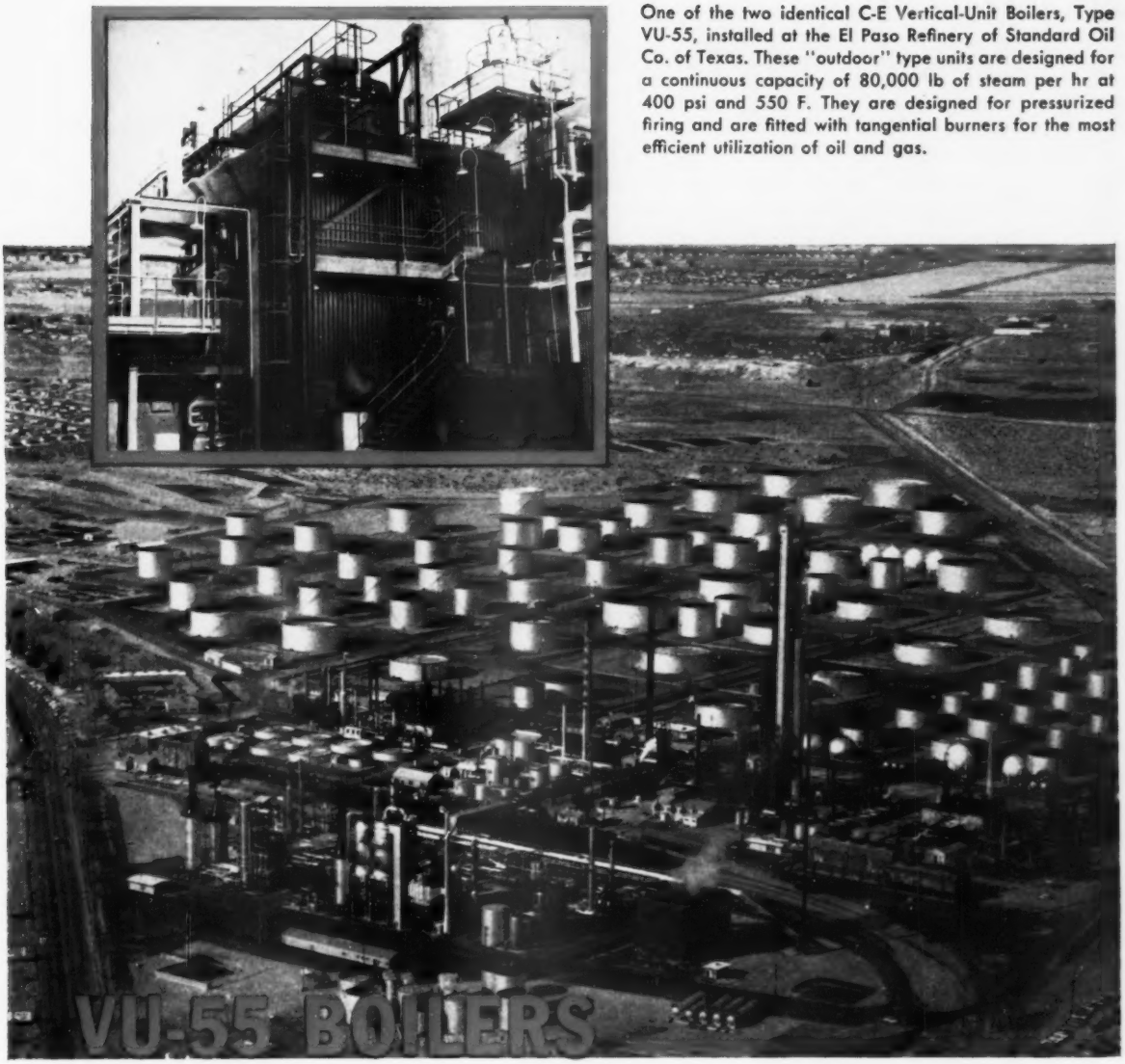
In this study, Calhoun has limited himself to the period beginning roughly with the Revolution and ending about 1840. It was an era when the military engineer, the civil engineer, and the architect were at least dimly recognized in America. It was also an era when the civil engineer was merely a non military man, rather than the specialist in a specific branch of engineering as he would be recognized today. Thus, Calhoun really is talking about all engineers, recognizing that their field of activity was proscribed by the demands of the time.

It is probably logical that Calhoun chose for his study those engineers who appeared in greatest number at the time – the builders of canals and railroads. But it must be recognized that even then, New York City was struggling with problems of water supply, and the odorous gas works already was afflicting the nasal passages of the City's aristocracy. Even if the engineers who worked on these problems were outnumbered by the canal and railroad engineers, it is just possible that they also were contributing to the development of engineering as a profession.

Whether they were or not, Calhoun's preoccupation with the canals and railroads is unfortunate in another sense, for it seems that because these projects were the creatures of the corporate giants of their day, the engineers who planned them must therefore be organization men. Thus, after struggling with the question of using practical craftsmen, gentlemen who dabbled in engineering, or professionals imported from Europe, the canal and railroad builders finally settled on organization engineers, trained within the business or governmental working units. At least, that seems to be the conclusion that Calhoun draws.

Unfortunately, this conclusion gives us no historical basis for the large and stable group of independent consulting engineers that exist today – and have for some time. Perhaps it is not proper to look to history for an explanation of this phenomenon. However, it would appear that Calhoun should have given more weight to the independence of some of his so-called organization engineers, for many of them, though remaining on the corporate payroll, reserved the right to make their services available as independent consultants. It is perhaps a flimsy thread on which to hang the history of the consulting engineer, but this situation persisted, even among the chief engineers of early 20th century manufacturing corporations. Today, corporate bonds still fall rather loosely about most members of the engineering profession.

But these speculations need not interfere with the consulting engineer's pleasure in reading about the origins of American engineer-



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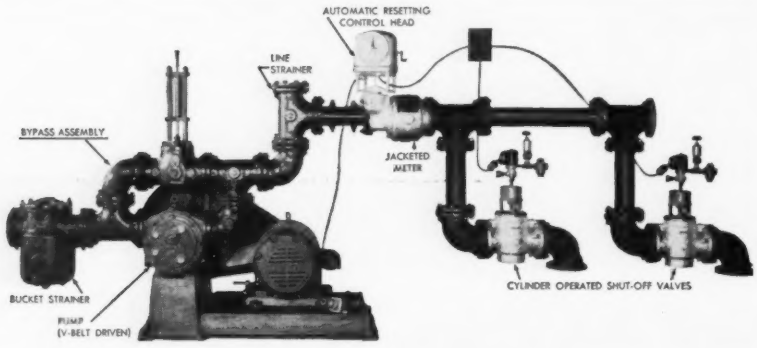

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ing. Calhoun's book is interesting, well researched, and valid in its conclusions for that great body of engineers in corporate or govern-

Benjamin Wright (1770-1842), the Father of American Engineering.

ment employ. It remains for some other author to do a historical study of the consulting engineer.

•

Professional Negligence, edited by Thomas G. Roady, Jr. and William R. Anderson; Vanderbilt University Press, Nashville, Tenn.; $10.00.

This is an interesting volume for the consulting engineer's library, for it places the subject of professional negligence in engineering in proper context with that in other professional fields. Unfortunately, it may come as quite a shock to doctors and lawyers that they have been grouped, not only with engineers and architects, but also with funeral directors and pharmacists. It can be assumed that engineers will take this broad definition of the term "professional" more philosophically.

At any rate, in an era when the problem of negligence is being forcibly drawn to the attention of consulting engineers, this volume will provide an excellent background on the subject. It is writ-

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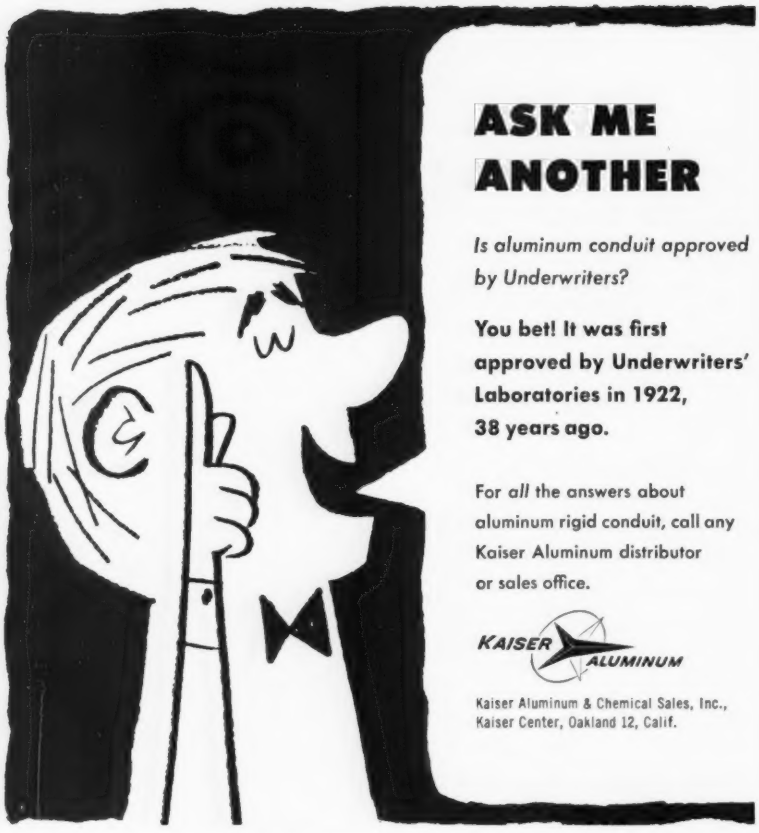
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ten in an interesting style, and though the text is amply fortified with case references, the engineer need not bother with them, for the most significant ones are amply detailed in the text itself.

Although the chapter dealing with the problem of engineers and architects is one of the shortest in the book, the brevity is not the result of omission. Rather, engineers and architects have been protected, at least in the past, by the courts which have erected a legal structure that has sheltered them from extensive liability. However, cracks have appeared in this structure, indicating that this chapter in future volumes be fatter.

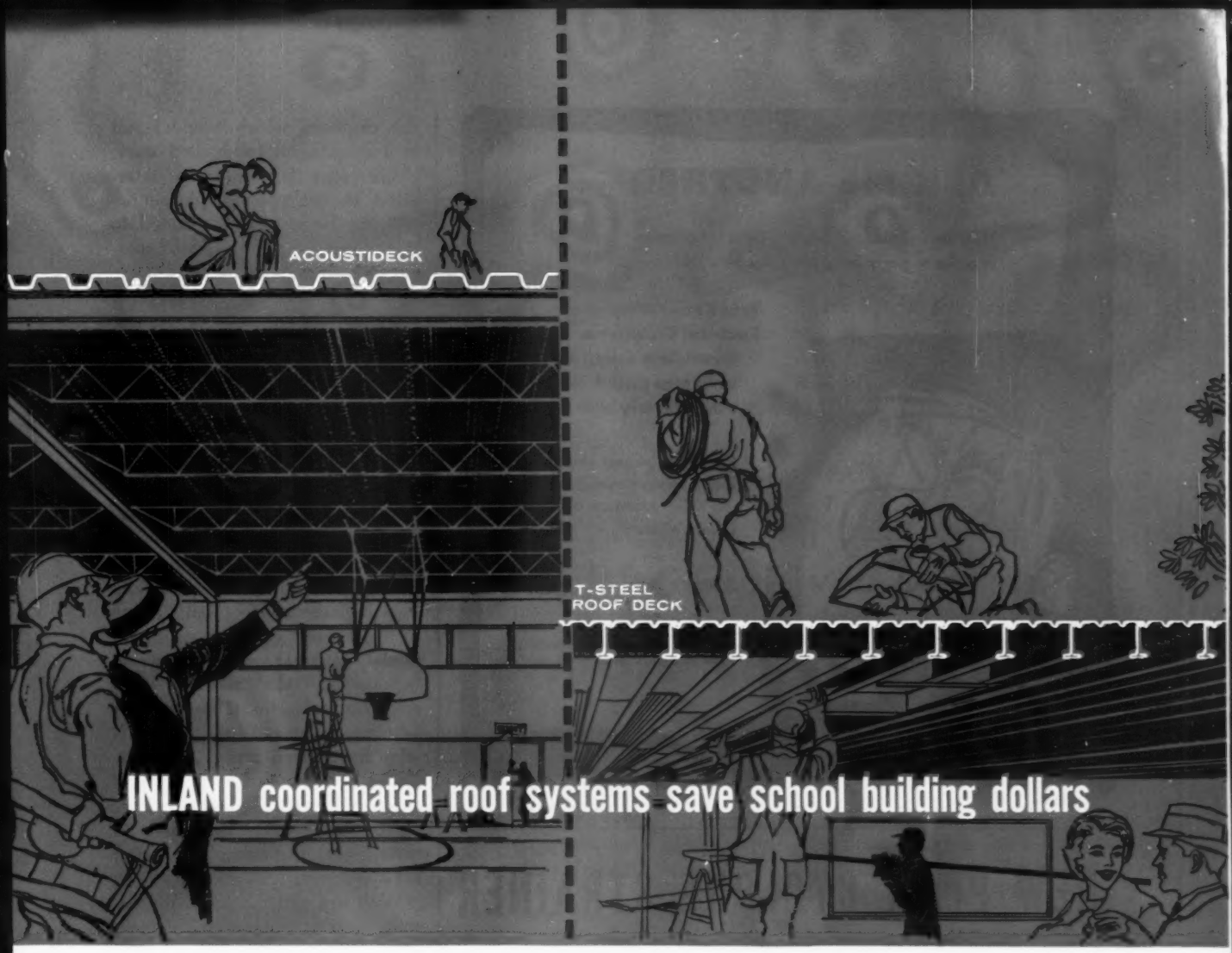
•

From Tin Foil to Stereo: Evolution of the Phonograph, by Oliver Read and Walter L. Welch; Howard W. Sams and Bobbs-Merrill, Indianapolis and New York; $9.95.

On the dust jacket this book is described as "the complete history of the phonograph, replete with romance, personalities, intrigue, litigation – the whole story of equipment development, from tin foil to stereo disc." The tone of this description is carried out in the jacket design which is bright and whimsical. The content is highly informative but stolid.

The authors have apparently labored long and devotedly in piecing together the history of the phonograph. They have consulted periodicals, company files, inventors' papers, patent records, and have had personal interviews, and correspondence. The organization is historical and the method is scholarly. To borrow the terminology of the scholar – this is a monograph.

As is true of many monographs it is myopic – it is a historical narrative *in vacuo*. Judging from the narrative the phonograph developed outside the historical environment made up of economic, sociological, political, and even personality components. These factors are mentioned but never given



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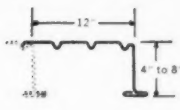

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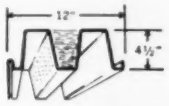

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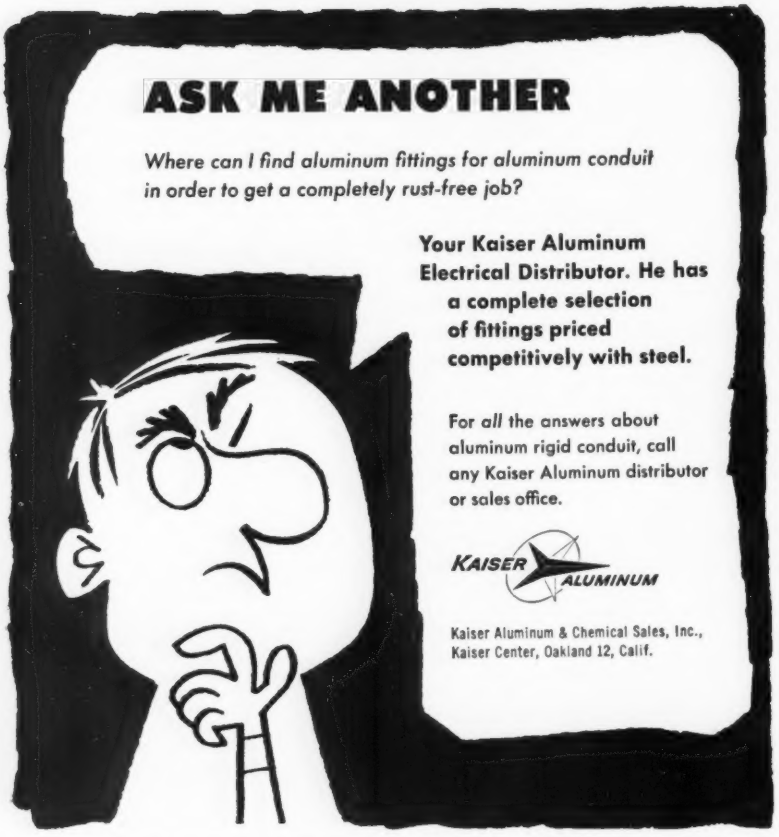
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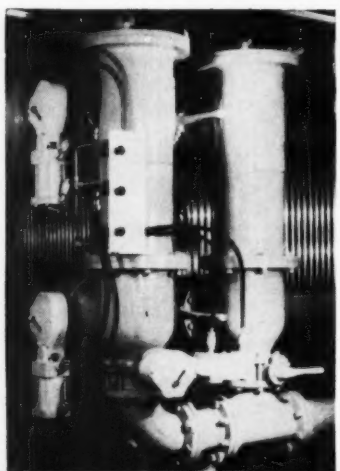

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the emphasis which would result in a meaningful full-bodied story.

Therefore the reader not interested in the phonograph *per se* will not be sensitively attuned to the "romance, intrigue, and personalities" that the authors undoubtedly read into their own work. On the other hand, the student of the phonograph – and there are some – will find a mine of information. From the student's point of view the book is an important contribution to the history of technology. Yet, it may be the student who will find fault with some of the generalizations. Certainly enough history of 19th-century technology has been published to demolish the opinion – usually held by Americans – that Europe in the last few centuries neglected applied science. The authors write, nonetheless, that "the European scientists were for the most part scholars, interested in . . . knowledge for its own sake . . . American scientists of the time might better be termed teachers, rather than scholars, interested more in testing and demonstrating practical application . . ."

With this generalization the authors dismiss the *Ecole Polytechnique;* the great German technical schools at Karlsruhe, Munich, Dresden, Stuttgart, and Hanover; and polytechnical institutes at Prague and Vienna – to cite only a few examples. Nor is it justifiable to characterize science students in 19th-century Europe as dilettantes. If the authors wished to explain the success of the American inventors and engineers in bringing their products to market, they should have studied readily available economic histories.

•

From Engines to Autos: Five Pioneers in Engine Development and Their Contributions to the Automotive Industry, by Eugen Diesel, Gustav Goldbeck, and Friedrich Schildberger; Henry Regnery, Chicago, Ill.; $6.00.

A book should be judged by its content – not by format. In the

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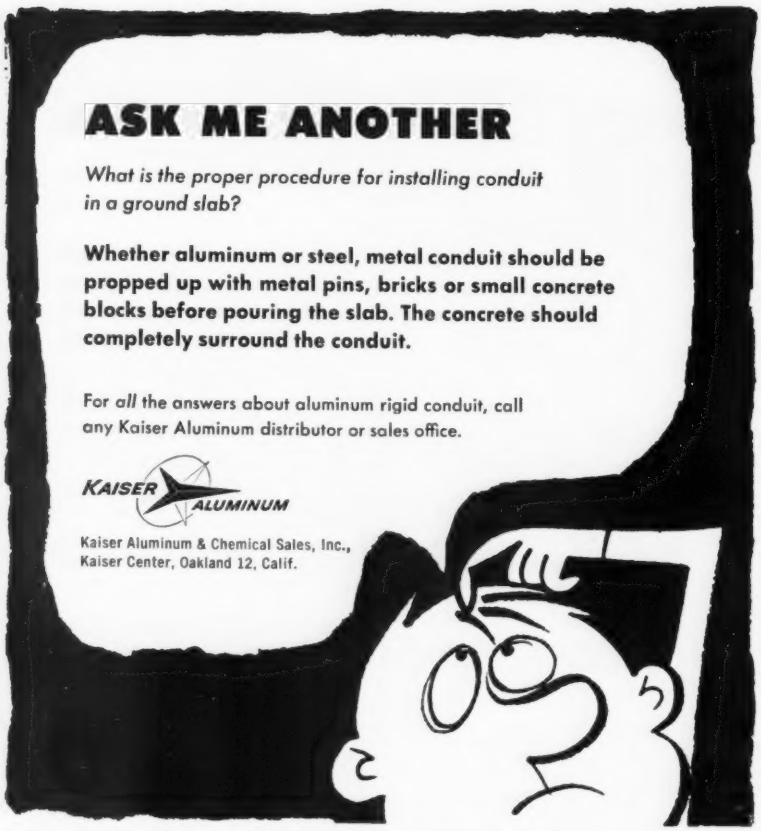
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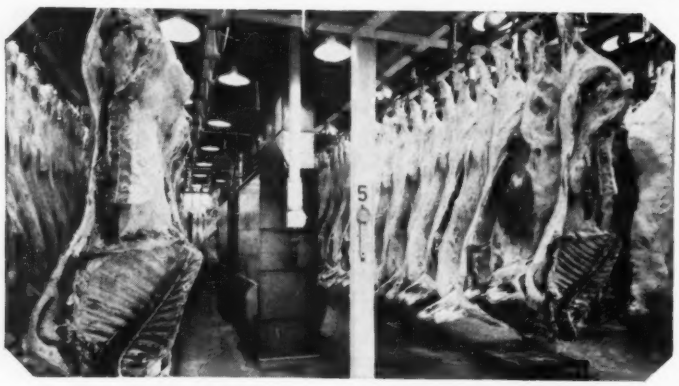

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case of *From Engines to Autos,* however, the publisher's ineffectiveness overshadows the substantial merits of the contents. The publisher has chosen to take an interesting and informative narrative, print it without imagination, bind it in a black cover, and release it not only without bibliography but also without index.

The essays in this volume give a history of the internal combustion engine in the late 19th century, as well as lively portraits of the men responsible for the development of the engine. From its pages emerge credible portraits of Nikolaus August Otto, creator of the four-cycle internal combustion engine; Gottlieb Daimler, designer of a high-speed automobile engine; Karl Benz, the world's leading automobile manufacturer at the turn of the century; Rudolf Diesel, the designer of the world-famous and efficient petroleum engine bearing his name; and Robert Bosch, designer and manufacturer of ignition systems and the fuel injection pump for the diesel engine.

All five of these men were German and the three authors of the essays are also German. *From Engines to Autos,* however, is not chauvinistic. Detroit may believe that the major steps from engines to autos were taken there, but in reality the major steps from autos to more autos were taken in Detroit. Eugen Diesel, author of the concluding chapter in *From Engines to Autos,* has the weight of supporting evidence when he writes "the origin of the motorcar is German."

Eugen Diesel, author of the essays on Rudolf Diesel and Robert Bosch, has written the most informative and readable sections of the book. His chapter on Diesel is especially commendable for its style, and insights into the personality of his subject. Unfortunately, he did not contribute a summary that would have related the essays in the volume. He might have attempted to tie together the

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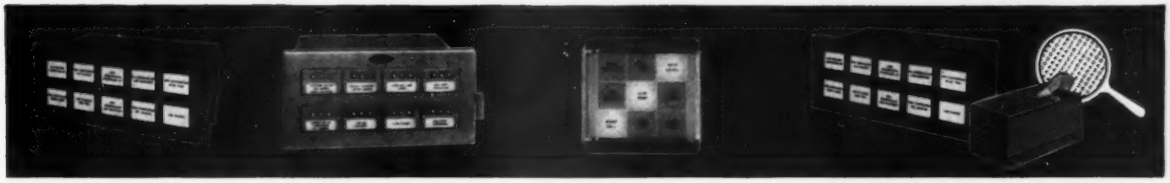

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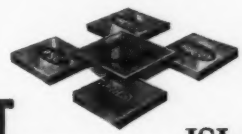

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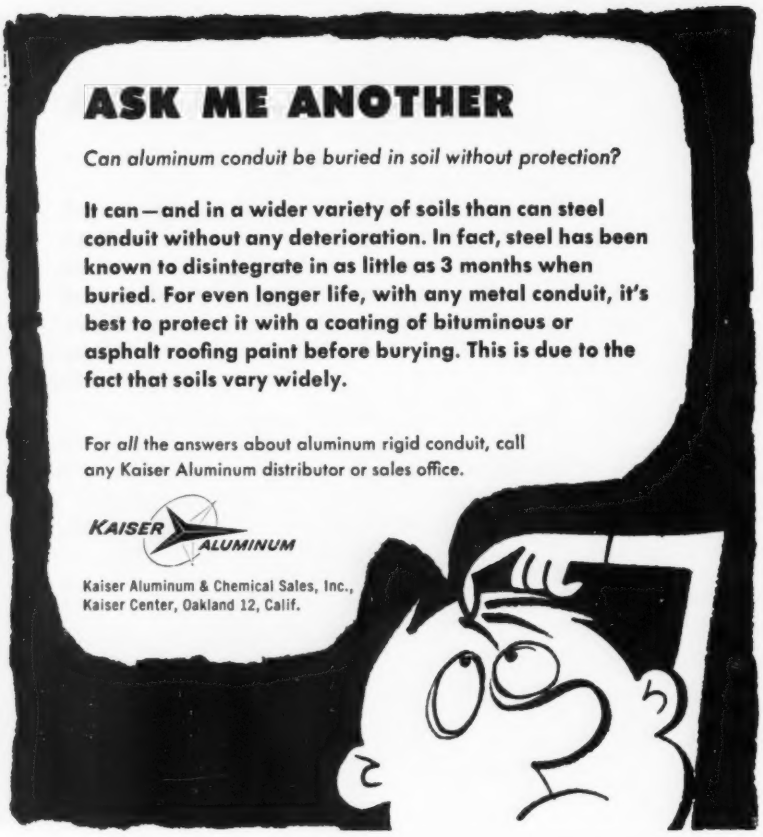
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For all the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.
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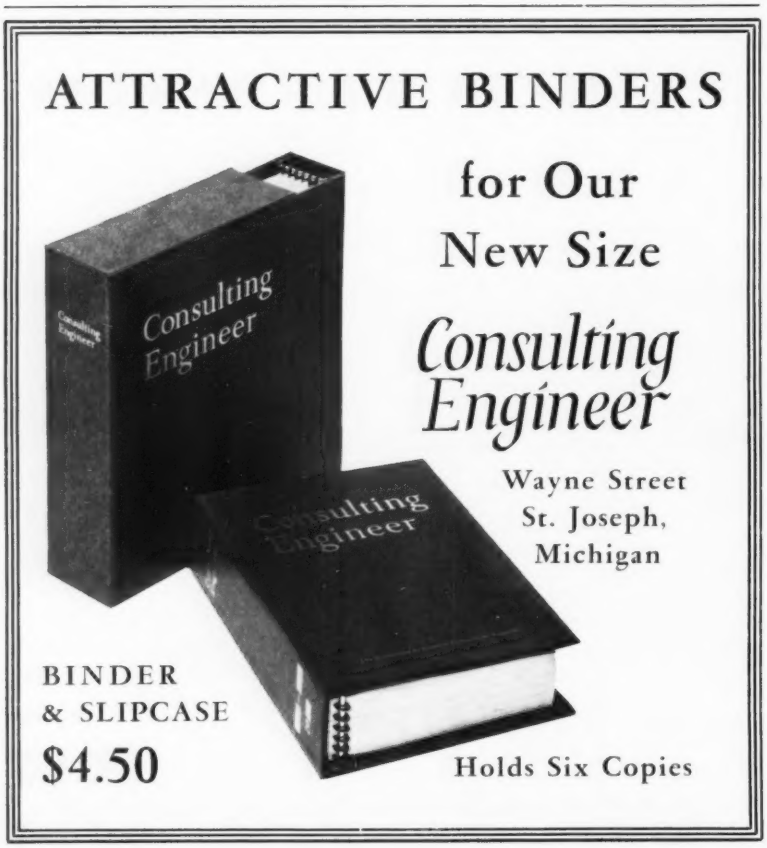

threads and to have answered some of the questions arising naturally from the biographical essays.

One significant question left unanswered is why the motorcar did originate in Germany. Judging from the material in this book, it might be concluded that technical education was a major reason for the success of the German pioneers. Daimler and Bosch studied at the Stuttgart Institute of Technology which may have been the "world's crack school" of technology in the late 19th century. Benz attended the polytechnical school at Karlsruhe where he profited from the influence of Ferdinand Redtenbacher's teaching, and Diesel studied at the technical university in Munich where he came under the influence of Professor Carl Linde, designer of the refrigeration cycle.

By way of contrast, John Rae, in his history of *American Automobile Manufacturers*, states that a surprising number of the pioneer automobile men in the U. S. were college-trained engineers, but "even so, the engineers were outnumbered and to some extent overshadowed by the men who had been trained as machinists and mechanics."

However, *From Engines to Autos* was not intended to be an analytical, but rather a biographical approach to these men of technology. The activity of Rudolph Diesel and Robert Bosch supports the hypothesis that successful engineers (and scientists) quite frequently assume that their training and experience give insights into social problems normally considered the province of politicians or social scientists. Diesel, for example, wrote *Solidarismus*, which he believed contained the solution of the whole social problem, and Bosch authored, "The Avoidance of Future Crises in the World Economy," which he "appeared to believe, in all seriousness . . . solved the social question." Neither man received recognition for his

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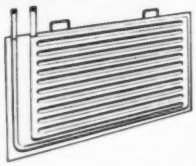

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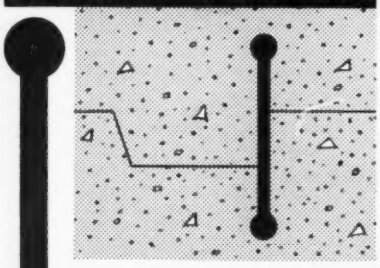

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excursion into an alien realm, and Eugen Diesel in his essay on Bosch comments, "the unsuccessful exertions of Diesel and Bosch show that it is infinitely more difficult to make people see reason than to build up the whole edifice of science and technology."

This book, in conjunction with a number of other studies now appearing will help us better to understand a force in the 20th century that has a great power to influence the course of history — the mind and personality of the engineer-scientist. It also will help us better understand the relationship which exists between the engineer and his environment.

•

New Technical Books

KINEMATICS OF MACHINES, by Rolland T. Hinkle; Prentice-Hall, Inc., Englewood Cliffs, N. J.; $7.50. This new and enlarged 2nd edition of a highly successful work on modern kinematics deals with the latest graphical and analytical material in the field. Included is a generalized complex variable method for velocity and acceleration analysis. The use of independent positions and loop equations is fully explained, as is the use of finite difference calculations for obtaining first, second, and third derivatives. Derivations are presented in detail and illustrated with solved examples throughout.

AERO-THERMODYNAMICS AND FLOW IN TURBOMACHINES, by Michael H. Vavra; John Wiley & Sons, Inc., New York, N. Y.; $14.50. The author has chosen a theoretical approach to flow phenomena in turbomachines which is based on the fundamental principles of fluid mechanics and thermodynamics — an approach which emphasizes basic physical processes rather than empirical methods connected with particular machines. One of the most valuable features of the book is the use of vector- and tensor-

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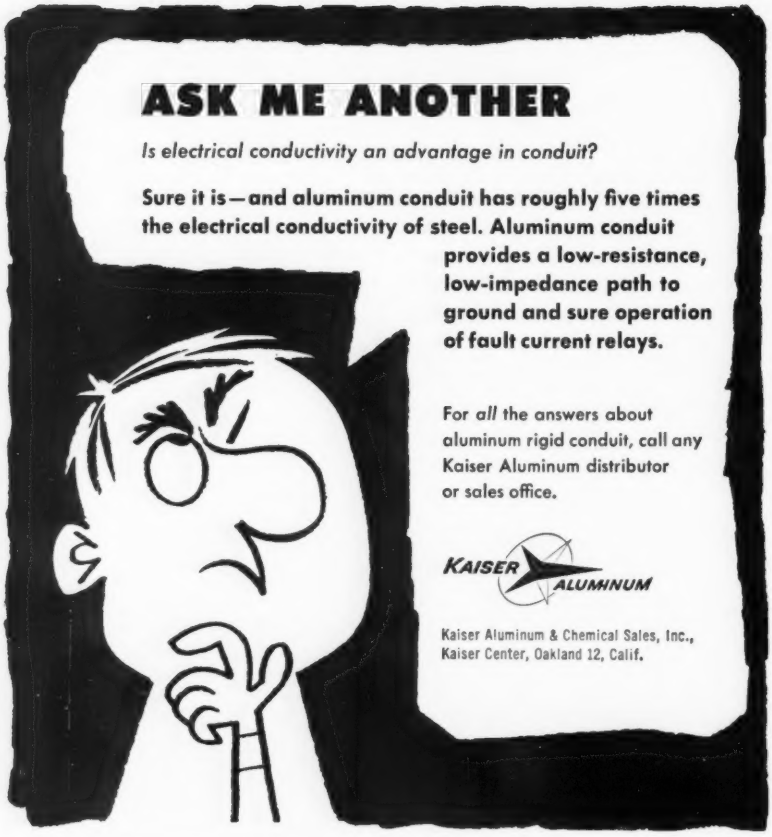
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Is electrical conductivity an advantage in conduit?
Sure it is—and aluminum conduit has roughly five times the electrical conductivity of steel. Aluminum conduit provides a low-resistance, low-impedance path to ground and sure operation of fault current relays.
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analysis to establish fundamental flow relations. By emphasizing basic physical theory this book provides a theoretical background which will prove of great practical utility with reference to the design of turbomachines.

ELECTRICAL SYSTEMS DESIGN, 2nd ed., by Joseph F. McPartland and the editors of *Electrical Construction and Maintenance;* McGraw-Hill Book Co., Inc., New York, N. Y.; $7.75. Modern standards, procedures, and developments in electrical systems design are brought together in the newly published revision of this practical guidebook. It covers electrical systems for such diverse uses as power, light, heat, air conditioning, and signals and communication. It also brings the reader abreast of advances in system design, and reflects changes in the National Electrical Code. Comprehensive, profusely illustrated, it will provide self-training in systems design for the newcomer to this field and a quick reference for the practicing designer.

STRUCTURAL MECHANICS, by Samuel T. Carpenter; John Wiley & Sons, Inc., New York, N. Y.; $9.50. This book sets forth, clearly and logically, the connection between structural theory and engineering mechanics. Discusses such topics as numerical methods, finite difference approximations, and buckling. It introduces the general principles of vibrations and structures subject to ground motion and impulsive loading, and covers combined beam-column action. It also shows how to use mathematical procedures (involving differential and integral calculus) in the solution of structural problems.

HIGHWAY AND AIRPORT ENGINEERING, by Adrian R. Legault; Prentice-Hall, Inc., Englewood Cliffs, N. J.; $11.65. This book is one of the Prentice-Hall series in civil engineering. It is an up-to-date ap-

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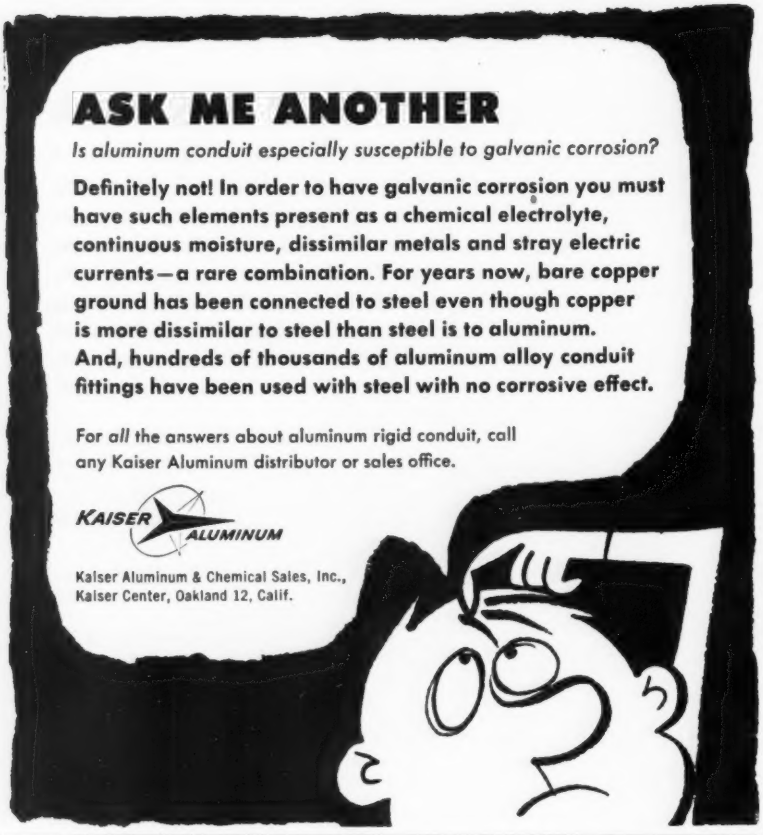
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Is aluminum conduit especially susceptible to galvanic corrosion?
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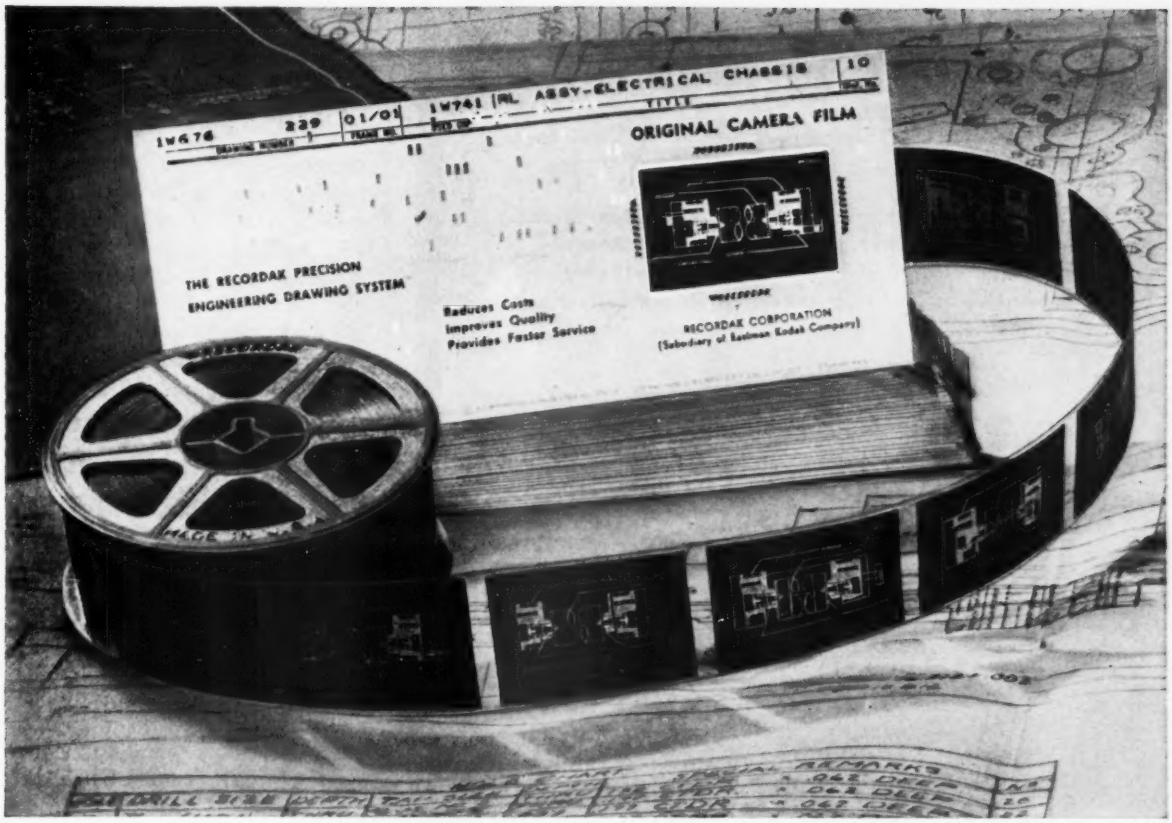
ENGINEERING MECHANICS: (DYNAMICS), Vol. II, by Irving H. Shames, Prentice-Hall, Inc., Englewood Cliffs, N. J.; $6.75. Dealing thoroughly with vector treatment, this new volume provides a background for advanced studies in space mechanics and furnishes a comprehensive general background in dynamics for contemporary engineers. It treats theoretical concepts with precision and rigor, and describes various practical applications to actual technological situations involving matter in motion. Requires no previous knowledge of vector algebra or vector calculus for complete understanding of material. A concise, logical treatment of the motion of a deformable medium and the concept of control volume paralleling the idea of the free-body diagram concludes the book.

DIRECT CONVERSION OF HEAT TO ELECTRICITY, edited by Joseph Kaye and John A. Welsh; John Wiley & Sons, Inc., New York, N. Y.; $8.75. This book is an edited collection of papers which have been prepared by principal persons in the



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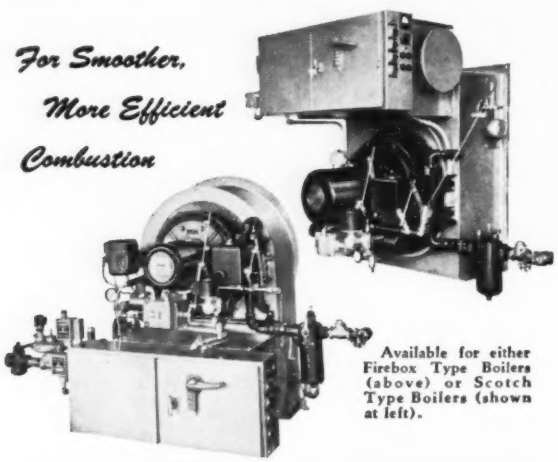

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ENGINEERING DATA PROCESSING SYSTEM DESIGN, by Arthur D. Even; D. Van Nostrand Co., Inc., Princeton, N. J.; $6.50. A written coverage of mechanization possibilities in that area of engineering which deals with drawings, engineering parts lists, and allied documentation. It serves as an authoritative guide in converting a manual system to a mechanized one, the most logical improvement before efficient conversion to an electronic data processing system can take place. The actual installation, including a set of sample forms, is thoroughly described. The organization, training, and retraining of existing personnel, system operations, and its control in emphasizing the industrial engineering approach to manufacturing is detailed.

APPLIED MECHANICS, by P. D. Collins; Longmans, Green & Co., Inc., London, England; $4.00. The scope of this book has been limited to the main topics which normally must be covered by students taking the final year of a part-time course of study in preparation for the (British) Ordinary National Certificate examination in applied mechanics. The text contains many examples. It covers statics, friction, dynamics, harmonic motion, stress and strain, bending moment and shearing force, bending of beams, torsion, hydrostatics, and hydrodynamics. ▲▲

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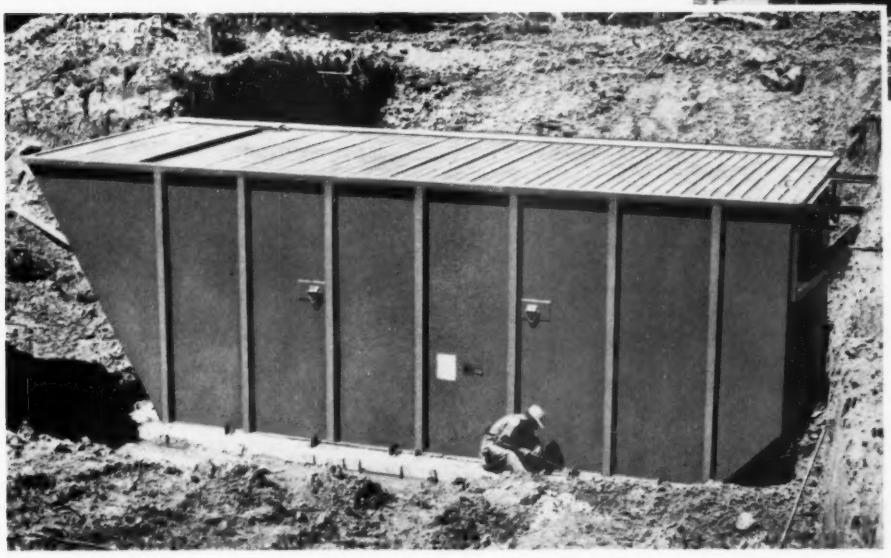

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Consulting Engineers' Calendar

Aug. 15-17. American Society of Mechanical Engineers and American Society of Chemical Engineers; Heat Conference and Exhibit, Statler Hilton, Buffalo, New York.

Aug. 17-19. American Society of Civil Engineers; Hydraulics Conference, University of Washington, Seattle.

Sept. 8-9. American Society of Civil Engineers; Conference on Electronic Computation, Hilton Hotel, Pittsburgh, Pennsylvania.

Sept. 15-16. American Society of Mechanical Engineers; Engineering Management Conference, Hotel Morrison, Chicago, Illinois.

Sept. 21-23. American Institute of Electrical Engineers and American Society of Mechanical Engineers; 1960 National Power Conference, Bellevue Stratford Hotel, Philadelphia, Pennsylvania.

Sept. 25-28. American Institute of Chemical Engineers; National Meeting, Hotel Mayo, Tulsa, Oklahoma.

Sept. 26-30. Instrument Society of America; Fall Instrument-Automation Conference & Exhibit, Annual Meeting, Coliseum, New York, N. Y.

Sept. 27-30. Prestressed Concrete Institute; 6th Annual Convention, Statler-Hilton, New York, N. Y.

Oct. 2-6. Water Pollution Control Federation; 33rd Annual Meeting, Convention Hall, Philadelphia, Pa.

Oct. 3-5. National Association of Corrosion Engineers and University of California; Corrosion Short Course, San Francisco, California.

Oct. 3-5. National Association of Corrosion Engineers and University of Oklahoma; Corrosion Short Course, Campus, Norman, Oklahoma.

Oct. 5. Society of Plastics Engineers, Inc.; Technical Conference — "Plastics vs. Corrosion," Mark Hopkins Hotel, San Francisco, California.

Oct. 10-14. American Institute of Electrical Engineers; Fall General Meeting, Chicago, Illinois.

Oct. 10-14. American Society of Civil Engineers; Annual Convention, Hotel Statler, Boston, Massachusetts.

Oct. 25. Association of Consulting Chemists & Chemical Engineers, Inc.; Annual Meeting and Symposium — "The American Consultant Outside USA," Hotel Shelburne, New York, New York.

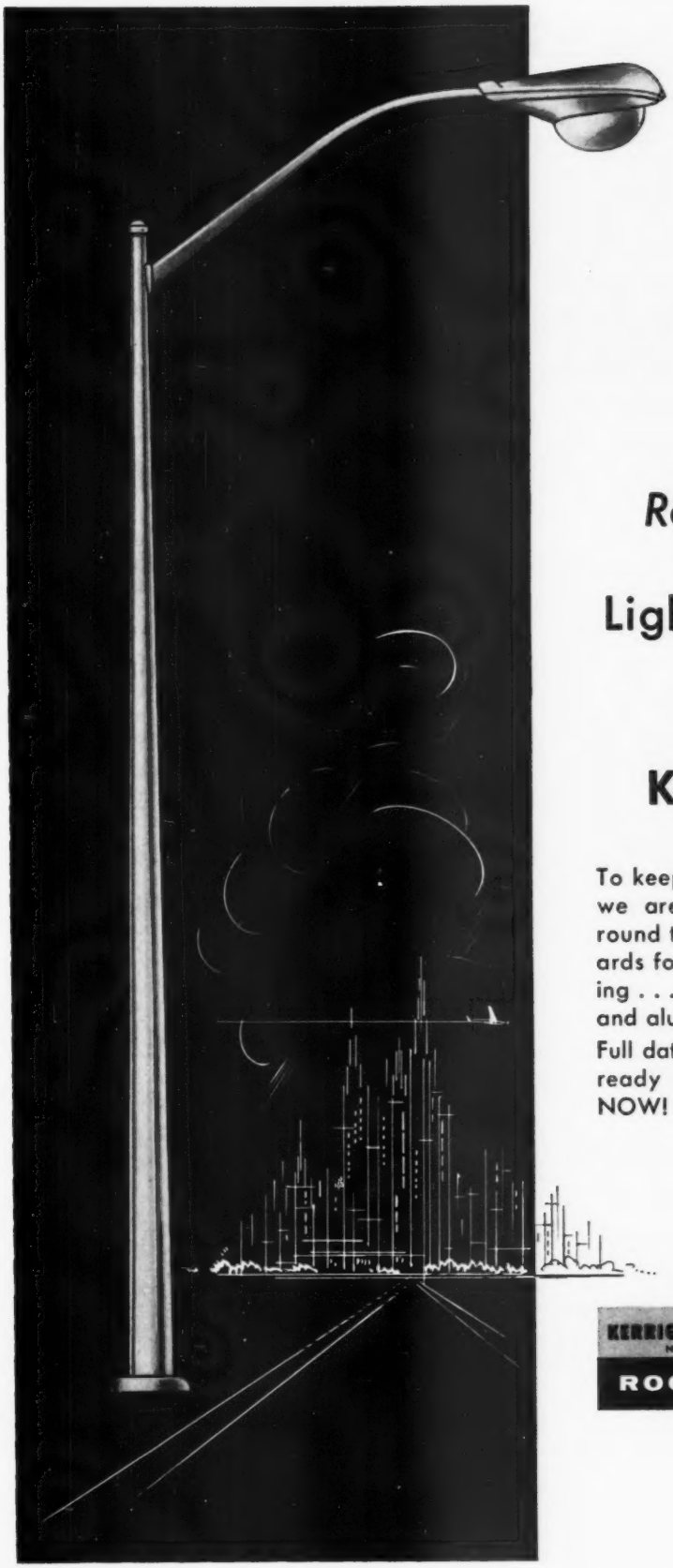
Oct. 31-Nov. 2. American Concrete Institute; 13th Regional Meeting, Pioneer Hotel, Tucson, Arizona.

Nov. 10-11. Kansas City Section, American Society of Civil Engineers; Power Conference, Continental Hotel, Kansas City, Missouri.

Nov. 15-16. Purdue University; Symposium on Engineering Applications of Probability and Random Function Theory, Campus, Lafayette, Indiana.

Nov. 15-17. Building Research Institute; Fall Conferences, Shoreham Hotel, Washington, D. C.

Nov. 27-Dec. 2. American Society of Mechanical Engineers; Annual Meeting and 24th National Exposition of Power and Mechanical Engineering, Statler-Hilton, New York, N. Y. ▲▲



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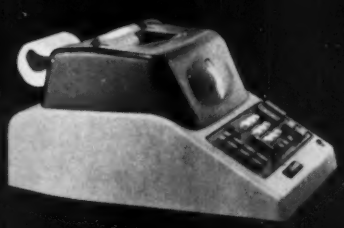
5 good reasons for specifying Alcoa aluminum electrical rigid conduit

1. Saves installation labor. Compare the 34-pound weight of a 10-foot length of 4-inch aluminum conduit with the 98 pounds of the same size in steel. This weight advantage pays off handsomely in all phases of handling. And, Alcoa aluminum conduit is easier to cut, thread and bend.

2. Appearance. With aluminum conduit you can forget staining of adjacent surfaces. Under normal conditions, there's no painting needed, because aluminum's natural good appearance is inherent.

3. Resists corrosion. This seamless extruded conduit stands up to most corrosive environments. It requires no galvanizing or other protective coating. Even in food processing plants it needs no paint.

4. Electrical advantage. Aluminum's low impedance, due to its nonmagnetic characteristic, coupled with its high electrical conductivity provides greater protection against ground-fault hazards. Phases may be separated and run in individual nonmagnetic aluminum conduit.

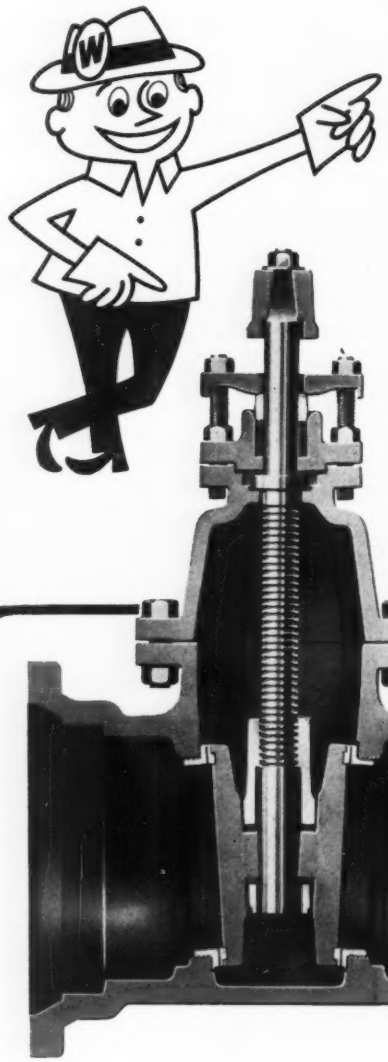


5. Over-all costs. Compare first cost of Alcoa aluminum conduit with steel conduit. Then consider the installation and maintenance savings, and the long-range value of aluminum really shows to advantage.

Get all the facts and figures in time for your next job. Contact your electrical distributor or one of our representatives. Or drop us a line for free literature. Write to Rome Cable Division of Alcoa, Dept. 7-80, Rome, New York.

ROME CABLE
DIVISION OF **ALCOA**

THE R. D. WOOD GATE VALVE



Bury it, yes, and if R. D. Wood made it, you can just about forget it, too. There are generations of reliable service built into the R. D. Wood Gate Valve. Simple, sound design is the secret; no delicate parts to get out of order, no pockets to fill up with sediment. Even after years of idleness in the lines, R. D. Wood Gate Valves operate easily, smoothly.

ONLY THREE MOVING PARTS:

The spreader and two discs comprise the complete internal mechanism. In closing, gates are first lowered into position before spreading action begins. Then spreading pressure is distributed evenly from the hub to permit the discs to seat without distortion. Both discs are equally tight against pressure from either side of valve.

AND THESE FEATURES, TOO: Made of thoroughly seasoned castings, rigidly inspected and tested to 300 pounds hydrostatic pressure. Available with bell, mechanical joint or flange pipe connections; conventional or "O" ring packings.

Conform to latest AWWA specifications

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers also of Mathews Modernized Hydrants, Mathews Flange Barrel Hydrants, R. D. Wood Hydrants, and "Sand-Spun" Pipe (centrifugally cast in sand molds)

Five-foot circular diffusers of PLEXIGLAS *at First National Bank of Marlin, Texas.*

Plexiglas . . . for lighting that stands out and stands up

Proper lighting is more than high footcandles and low brightness ratios. It conveys a *quality* feeling in keeping with the design of a handsome building. This is why so many of today's best buildings have lighting equipment that includes diffusers or lenses made of PLEXIGLAS® acrylic plastic. In addition to providing highest efficiency in transmission and diffusion, PLEXIGLAS is a rigid, smooth, durable material—highly resistant to breakage and free from discoloration in long term service. PLEXIGLAS is the word for quality lighting.

We will be pleased to send you the names of manufacturers whose lighting equipment is based on the use of PLEXIGLAS.

Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

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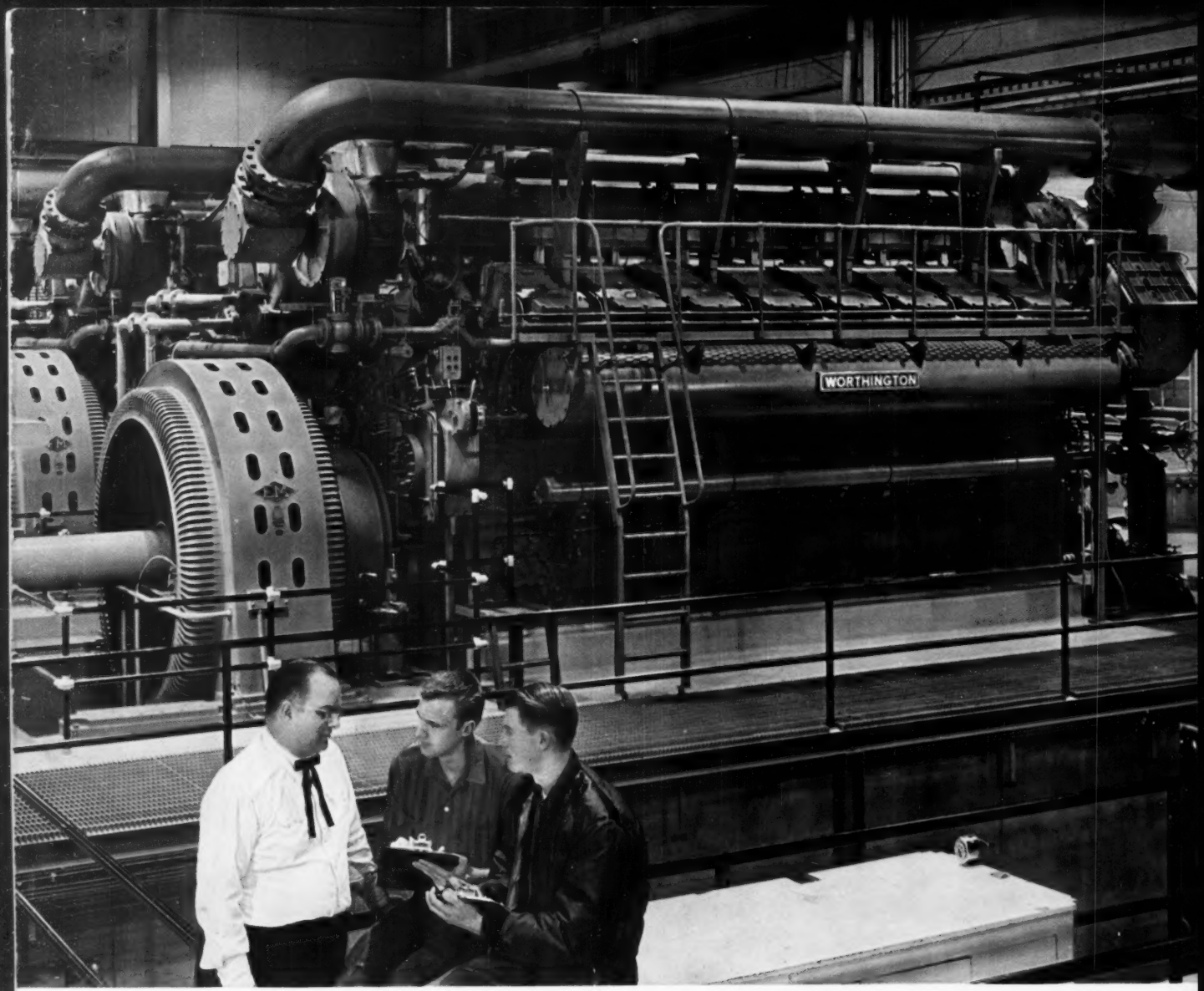
PLEXIGLAS



Worthington engines play a big part in . . .

THE BOOM IN BIG DIESELS

What is the most efficient prime mover?

The diesel, invented before 1900, is still most efficient. A typical 3,000kw Worthington high output engine is, for example, 25% more efficient thermally than a comparable steam or gas turbine.

Despite this, demand for big stationary diesels—500 to 6,000 hp—remained fairly constant until recently. But today, the market is rediscovering their basic values . . . some old . . . some excitingly new . . . all demanding a fresh look at the low cost of producing power with big stationary engines.

One value, for example, is that these engines never seem to quit. Prime reason is their slow rotative speeds—the fastest Worthington diesel turns a relatively slow 450 rpm. In fact, one Worthington engine clocked over 13 years of operating life on its original pistons and liners.

Another value is that fuels can be switched at the drop of a price. Thus for varying fuel costs, the Worthington engine that runs on gas, diesel oil or a mixture of both is increasingly desirable. Through this dual fuel operation, many municipalities, private utilities and industrial plants have reported fuel saving up to $5,000 a month.

Turbocharging muscles are, of course, essential. How important? A typical Worthington turbo-charged engine is 15-20% more efficient than the best naturally aspirated unit. Today every user knows how turbo-charging pays off. Yet today only Worthington is squeezing the most from it by designing for high pressure operation above 200 bmep. This latest engine is the Worthington SW14, now proved by over 200,000 hours of operation. Built in ratings from 1,500 to 5,000 hp, it has all fuel and other options that make these engines so versatile.

Heat harnessing helps, too. In any engine, much fuel energy is lost in generation of heat. With special engine jacketing that transforms water to steam for heating or other process purposes, and by recovering lube oil heat and exhaust heat, the efficiency can be boosted to 76%.

To learn more about these big stationary engines, we'd like to send you a copy of "Engine-eering." It's a folder of recently published articles on these engines. Please write Worthington Corporation, Section 43-15, Harrison, New Jersey.

WORTHINGTON

2-2

Part 2 August 1960

Consulting Engineer

Keep This Directory in Your
Technical Reference File

A DIRECTORY OF ADVERTISERS' LITERATURE

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AIR CLEANERS & DUST COLLECTORS

1—Industrial Dust Collectors

Bulletin 370.100 describes floor- and hopper-mounted industrial dust collectors. Both models feature easily cleaned cloth filters, safe vacuum operation, efficient and simplified dust removal. Hopper-mounted unit has specially designed loading chute to screen out foreign matter. Photographs and diagrams.

Wallace & Tiernan Inc.

2—Air Filters

Bulletin B-1400-6 describes Farr's *Roll-Kleen* air filter. Comes in kit form to assemble at the point of installation. Line drawing shows construction and operation. Includes design, media, performance, installation, and maintenance. Tables show capacity in cfm and weight in lbs. Specifying instructions.

Farr Co.

3—Portable Dust Collectors

Small and medium size dust collectors, applicable to single machines or small groups of equipment producing undesirable dust, are described in four-page bulletin 162-6. Capacities range from 300 to 1350 cfm; 5000 fpm velocity in pipes, and 8 in. static pressure at fan.

Buell Engineering Company, Inc.
Northern Blower Division.

4—Floating-Bed Wet Scrubber

Special bulletin introduces the new Aerotec floating-bed wet scrubber for removal of tars, dusts, oils and suspended particles from gas or air. Provides self-cleaning action in removal of wetted solids. Cut-away illustrations and installation photos, with listing of 12 standard models, 1500 to 40,000 cfm.

Aerotec Industries, Inc.

5—Cloth Type Dust Collectors

Bulletin 10-27-59 describes the *Roto-Jet* cloth-type dust collector designed by Dustex to eliminate usual cloth filter problems. Rotating blow tube and roller support system requires no reversing mechanisms, operates with low torque, prevents cloth jamming. Drawings illustrate operating principles.

Dustex Corp.

6—Air Hygiene

Bulletins K-856 analyze problems of micro-organisms in industrial processing plants and hospitals. Solution with *Kathabar* equipment is offered. *Kathabar* systems destroy 97% of bacteria and mold in hospitals, food and chemical plants and maintain specified humidity conditions. The two bulletins will be sent.

Surface Combustion.

7—Centrifugal Dust Collectors

Bulletin M210 describes the 9VGR Multiclone dust collector used in cement, metallurgical, chemical, and general industries. Cutaway shows construction of Western Precipitation's Multiclone dust collector. Important features described and illustrated with line drawings. Equipment backed by 25 years experience.

Western Precipitation Div. Joy Mfg. Co.

8—Electronic Air Cleaners

Catalog 1460 illustrates and describes the Model PA and PF Westinghouse *Precipitron* electronic air cleaner. Physical dimensions and capacities are given in tabular form. Included also are application features and cycle of operation. Addresses and telephones of sales offices.

Westinghouse Electric Corp.,
Sturtevant Division.

9—Dust Control Equipment

Bulletin No. 805 describes a complete range of dry collection equipment including the multi-bag filter, uni-filter, glass bag filter, *Whirl-clone*, special collectors, and accessories. Illustrated application data shows how equipment is used in industry to collect dust and to reclaim reusable material. Illustrated.

Dracco Division of Fuller Co.

10—Air Purification Equipment

Bulletin 108A describes and illustrates *Dorex* activated carbon air purification equipment, C cells and H canisters. Data on equipment selection, installation, application is provided. Also given is information on unique *Dorex* replacement service. Discussions of activated carbon and conditions for proper purification.

Connor Engineering Corp.

11—Dust and Mist Collectors

Bulletin 736 illustrates the entire Aget line and includes complete dimensions and specifications. Forty basic *Dustkop* units will collect everything from wood chips to fine dust particles. Also 4 *Mistkops*, 4 *Filterkops*, 2 *Dustbusters*. Descriptive copy and recommended uses for models. Photographs of installations.

Aget Manufacturing Co.

12—Dust Collectors

Bulletin describes savings in maintenance and employee efficiency accomplished through proper control of manufacturing dust. Easily installed or moved. Adaptability of Torit dust collectors to typical industrial requirements is explained. Products and all types of installations are shown in photographs.

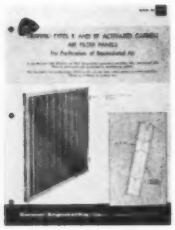
Torit Manufacturing Co.

AIR CLEANERS & DUST COLLECTORS *continued*

13—Cyclone Dust Collectors

Bulletin C-103 describes design and construction of Buell high-efficiency cyclones. Features include exclusive "Shave-off" port which traps extra percentage of dust, particularly smaller fines. Fully illustrated. Lists all information necessary for specifying. Covers importance of manifolding.

Buell Engineering Co., Inc.



14—Activated Carbon Filters

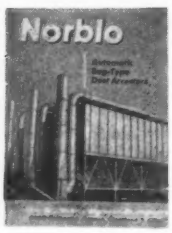
Bulletin 107 describes and illustrates Dorex Types R and RF activated carbon air filter panels, low cost, high efficiency units designed to purify recirculated air. Ease of installation and simple refilling explained. Cutaway shows panels' function. Dimensional diagrams, capacities, methods of installation included.

Connor Engineering Corp.

15—Cyclone Dust Collectors

Bulletin 10-26-59 describes Dustex cyclone dust collectors for product recovery and dust nuisance elimination where ultra-high *Miniature* efficiencies are not required. Cutaway with captions pictures operating principles. Graph shows pressure drop across collector. Dimensions of various models.

Dustex Corp.



16—Bag-Type Dust Collectors

How the *Norblo* automatic bag-type dust collector can provide continuous operation at full capacity is explained in four-page folder 164-5. Dimensions and capacities are listed in tabular form. A flow diagram explains how the unit works. Each part of the collector is shown separately with its description.

Northern Blower Co.

17—Multiple-Serving Dust Collectors

Dustkop model 30N50P, a one-unit system serving 7 grinders. Where floor space is limited, unit is suspended from ceiling or installed on roof. Pipe is angled from collector to caster-mounted dust drum placed in any unused area. Drum is rolled to outside dumping point and emptied without recirculating dust.

Aget Manufacturing Co.

18—Mechanical Dust Collectors

Booklet F-104 fully discusses the problem of dust recovery and the important factors to be known in the selection of the proper method. Explains methods and the difference between Multiclone and cyclone separators. Many line drawings show operation. Cutaways show 9VGR Multiclone features, construction.

Western Precipitation Div. Joy Mfg. Co.

19—Disposable Filters

Bulletin B-1300-4 describes Farr's high efficiency, completely disposable filters designed for applications requiring maximum air cleanliness. Gives description application, advantages, and components. Specifications include capacities, dimensions, and weights. Graphs show resistance characteristics.

Farr Co.

20—Industrial Dust Collectors

Catalog 359 describes briefly complete line of Torit dust collectors for industry. Current models of both self-contained cabinet cloth filter type and cyclone separators are illustrated with dimensions and specifications for each. Installation photographs illustrate all models in use. Accessories are listed.

Torit Manufacturing Co.

AIR CONDITIONING & REFRIGERATION

21—Chillers and Condensers

Bulletin 8027B describes new *ARPC* air cooled package chillers and *RCU* remote condensing units made by Dunham-Bush. Catalog includes capacity data, specifications, component and dimensional data, curves, and wiring schematics for dry expansion and chilled water uses.

Heat-X, A Subsidiary of Dunham-Bush, Inc.

22—Product Coolers

Recold Catalog 8COa describes a complete line of vertical and horizontal product coolers with centrifugal blowers for high temperature (above 34°) or freezing type applications utilizing hot gas or water defrost. Available in large range of sizes and capacities circuited for R-12, R-22, or ammonia.

Recold Corp.

AIR CONDITIONING & REFRIGERATION *continued*

23—Central Air Conditioners

Revised Bulletin 30 describes Marlo central station air conditioning units for heating, humidifying, cooling, dehumidifying, filtering, circulating. Ceiling or floor mounting types, horizontal or vertical air flow. Includes illustrations, construction features, performance data, charts, diagrams.

Marlo Coil Co.

24—Hermetic Liquid Chillers

Catalog ME-121 describes and illustrates complete line of factory packaged liquid chiller units with hermetic type compressors from 7.5 to 45 ton capacities. Gives engineering details as well as complete capacity data on each unit. Cutaway shows construction. Dimensional drawing and complete specifications.

Airtemp Division, Chrysler Corp.

25—Air Conditioning Units

Bulletin 230 describes Bohn's new line of remote air conditioning units. Capacity data is given for direct expansion, cold water, hot water, and steam. Six models provide cooling capacities from 2 to 15 tons to handle a wide variety of applications. Tables show refrigeration and air conditioning capacities.

Bohn Aluminum & Brass Corp.

26—Airfoil Bladed Fans

Bulletin A-1103 describes centrifugal type, airfoil bladed fans manufactured by American-Standard. Available for general ventilation and industrial process applications. For conventional low velocity or high velocity conduit and double duct air conditioning systems. Illustrations include models and components.

American-Standard Industrial Division.

27—Induced-Draft Cooling Towers

Catalog 22L-14 covers important design features built into large capacity, all-steel towers using lightweight, plastic-fortified pure cellulose fill. Includes complete engineering, dimensional, and loading data, along with full-operating range selection curves. Capacities range from 150 to 700 tons in a single cell.

Carrier Corp.

28—Air Conditioners and Refrigerators

Bulletin RS2E covers line of air conditioning units, 3 through 60 tons, and packaged liquid chillers 7½ through 125 tons. Complete specifications including cooling capacity, dimensions, and weights are given. Units are illustrated. Other products manufactured by Curtis Manufacturing Company are illustrated.

Curtis Manufacturing Co.

29—Cooling Towers

Complete, up-to-the-minute specification, dimension, and selection data for Acme Industries entire line of *Flow-Mizer* cooling towers has been incorporated in Acme's recently released Catalog 91-361. Includes, in addition, full details on the many important *Flow-Mizer* features.

Acme Industries, Inc.

30—Dual Duct Air Mixing Units

Bulletin DD-6 describes dual duct air mixing units for high and low velocity systems. Detailed information includes blue prints showing different arrangements for same space, cross-section diagrams, dimensions, performance data, and complete specifications. Installation and product photographs are shown.

Buensod-Stacey, Inc.

31—No-Frost Freezing and Storage

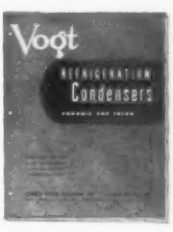
Bulletin 105 shows improved apparatus to prevent frost accumulation on refrigerated coils of large scale freezing or cold room installations. Convenient disposal of condensed moisture and completely automatic, trustworthy refrigeration with rapid chilling of products and assured holding of low temperatures.

Niagara Blower Co.

32—Air and Light Diffusers

Catalog F-9768 describes Air and Light Diffusers contained in one unit and manufactured by Barber Colman Co. and Day-Brite Lighting, Inc. Illustrated with line drawings showing construction and operation as well as photographs picturing various models. Includes accurate performance data for proper selection.

Barber-Colman Co.



33—Refrigeration Condensers

Engineering data on a complete range of sizes and types of condensers for ammonia and Freon refrigerants are given in 40-page bulletin RC-2, "Refrigeration Condensers." Closed, horizontal multi-pass types, and open, vertical single-pass types are featured. Piping sizes and temperature tables also are included.

Henry Vogt Machine Co.

34—Curtain Wall Air Conditioners

Bulletin PW-319 describes a new concept of curtain wall function, room-by-room air conditioning, an integral part of the Lupton curtain wall system. This is a true perimeter type system affording individual room control. It is a space saver and is easily installed. Includes capacities, dimensions, and specifications.

Michael Flynn Manufacturing Co.

AIR CONDITIONING & REFRIGERATION *continued*

35—Absorption Chilling Systems

Catalog EM 60-2236 describes the York absorption chilling system and how it operates. Outstanding features are listed and explained. Cycle diagram in full color shows operation with each color keyed to different element in the chiller. Specifications for various models are shown in table form.

York Corp.

36—Control Performance Test Report

Barber-Colman Company of Rockford, Illinois, has issued a performance test report on an electric unit ventilator controls installation in Zion, Illinois. The 14-page report tells of advantages gained through ratio room and discharge control for accurate control of room temperature. Photographs and charts.

Barber-Colman Co.

37—Remote Air Conditioners

Bulletin 3355 describes Marlo *Seazonaire* remote room air conditioning units for multi-room installations, available in six standard types, floor or ceiling mounted, finished cabinet or recessed, capacities from 210 to 1260 cfm. Included are construction details, specifications, and installation dimensional drawings.

Marlo Coil Co.

38—Heating and Cooling Coils

Catalog HC-1 gives complete construction specifications and dimensions on the Bohn line of direct expansion, water, and steam coils. This engineering manual is tailored to the needs of a specifying and design engineer as it provides a wide range of capacity data in easy-to-use direct selection tables. Illustrated.

Bohn Aluminum & Brass Corp.

39—Automatic Air Purifier

Now, from the company that developed air conditioning, comes the first practical air purifier for larger commercial and industrial heating and air conditioning systems. It cleans the air without using activated charcoal, removes odors, and adds moisture to dry air. Bulletin 31BA2 describes this 4000 cfm module.

Carrier Corp.

40—Multi-Zone Air Conditioning

First complete reference data on design and layout for multi-zone installation practice. Text, 24 pages, covers construction details, design procedures, basic air distributing schemes, air handling apparatus, budget costs, automatic control, winter and intermediate operation, specifications. Valuable for the designer.

Buensod-Stacey, Inc.

41—Room Air Conditioners

Bulletin 6014 is packed with technical data on Dunham-Bush "CR" *Year 'Round* room air conditioners, for unit system. Designed for multiroom buildings with individual room control of heating and cooling without affecting other rooms or zones. Typical installations, specifications, capacity data, dimensions, and ratings.

Dunham-Bush, Inc.

42—Air-Cooled Condensers

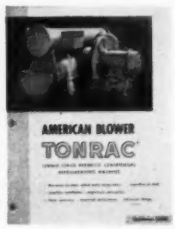
Recold Catalog 34C9a describes the specifications and features of *Dricon* air-cooled condensers for either vertical or horizontal air flow. Features quiet belt-driven fans and balanced circuiting for maximum efficiency. Available with multiple circuiting and with *Wintermatic* head pressure control.

Recold Corp.

43—Packaged Liquid Chillers

Catalog ME-123 describes complete line of factory packaged liquid chiller units with a full range of capacities from 15 to 125 hp and employing reciprocating compressors. Gives engineering details as well as complete capacity data on each unit. Completely illustrated including cutaways. Dimensions, specifications.

Airtemp Division, Chrysler Corp.



44—Centrifugal Refrigeration

Bulletin 1426 describes American-Standard's *Tonrac* centrifugal refrigerating machines. Available for cooling liquids for air conditioning and process applications. Compressors are driven by hermetic or open electric motors, turbine, or motor-gear combinations. Cutaway shows construction. Other products pictured.

American-Standard Industrial Division.

45—Evaporative Condensers

Catalog 91-311 includes all the latest information on features, capacities, application, selection, and specifications for the complete line of *Flow-Mizer* evaporator condensers offered by Acme Industries. Eleven models, capacities to 200 tons. Illustrations show construction and operation.

Acme Industries, Inc.

46—Air Conditioner, Dehumidifier

Bulletin 140 describes means of precise manipulation of humidity and temperature, air-conditioning critical processes of drying, and holding heat-sensitive materials, using absorbent liquid to dry air at moderate temperature without refrigeration. Diagrams, photos, chart of dehumidification, units up to 20,500 cfm.

Niagara Blower Co.

AIR CONDITIONING & REFRIGERATION *continued*

47—Packaged Liquid Chillers

Bulletin RS10W describes Curtis packaged liquid chillers, 7½ through 125 tons, with either direct drive compressor, semi-hermetic compressor, or open reciprocating compressor. Basic chiller principle described and illustrated with schematic. Applications for various industries listed. Each type chiller illustrated.

Curtis Manufacturing Co.

48—Air Conditioning Data File

A new high velocity data file is designed to help the air conditioning industry utilize the advantages of high velocity air transmission and distribution. It discusses what high velocity is, what it can do, and where it should be used, duct design, duct construction, and temperature control.

Barber-Colman Co.

49—Central Plant Air Conditioners

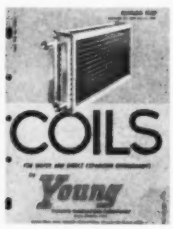
Engineering catalog with illustrative and descriptive information and complete selection data on central plant conditioners, multizone conditioners, sprayed coil units, heating-ventilating units, cooling and heating coils. This catalog is notebook type and is index tabbed for easy and quick use.

Thermal Engineering Corp.

50—Cold Plates and Snow Pans

Bulletin 663 gives data and specifications on Dean cold plates and snow pans for food service display and preservation. Promotes food sales by keeping food absolutely sanitary at all times. No cracked ice. Easily cleaned. Shows how to do your own estimating. Beautifully printed in four colors.

Dean Products, Inc.



51—Water and Refrigerant Coils

Catalog 5559 contains a full description of a complete line of water and direct expansion refrigerant coils. The catalog describes exclusive construction features with physical and performance data. Piping diagrams, architectural and engineering specifications, and many illustrations are included.

Young Radiator Co.

52—Central Air Conditioners

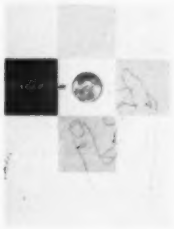
New bulletin AC-121 gives complete data on "Buffalo" Model G central station air conditioning cabinets. Type PC for horizontal floor or ceiling installation, type UPC for vertical operation, type PCW spray coil for horizontal operation, type VPCW spray coil for vertical operation. Details on performance data.

Buffalo Forge Co.

53—Central Station Air Conditioners

Bulletin AC1001A is prepared to provide the Consulting Engineer with a packaged 7½ to 60 hp complete, air conditioner engineering manual. No longer is a detailed specification of built-up equipment necessary. Needed is duct distribution and utility hook-up only. Tables, graphs, and diagrams are included.

Crane Co.



54—Air Conditioning and Drying

Bulletin K-160 describes the latest model (Model C) *Kathabar* Air Conditioning and Drying Systems. The equipment is used to stop condensation; speed drying and other processing operations; obtain sub-freezing dew-points; make air sterile to hospital standards. Multicolor diagram shows operation. Fully illustrated.

Surface Combustion.

55—Gas Air Conditioners

Illustrated bulletins on models of Arkla-Servel Sun Valley *All-Year* gas air conditioners; Model 500, 3½-ton; Model 750, 5-ton; Model 750H, High-Heat version of 5-ton unit. Explains operating cycle and gives cooling and heating specifications. Line drawings with dimensions. Combination sheets available.

Arkla Air Conditioning Corp.

56—Curtain Air Conditioners

An eight-page booklet of architect sketches showing different applications of the Lennox Comfort Curtain system for heating, ventilating, and air conditioning classrooms. An attractive two-color booklet, this brochure shows heater rooms and heating equipment integrated into the design of schools and libraries.

Lennox Industries Inc.

57—Motorless Valve Attenuator

Bulletin K-45 describes the new Connor *Kno-Draft* Series 45P valve attenuator, which uses no motors or linkage of any kind, and is designed for use in dual duct high velocity air distribution systems. Features are listed, function explained and diagrammed, performance data, and dimensions.

Connor Engineering Corp.

58—Water Chilling System

Catalog EM 60-2235 describes the compact hermetic *Turbopak* used for various water chilling applications. Capacity 65 to 600 tons. Most compact hermetic centrifugal water chilling system. Cutaway shows operation and component parts. Operation is carefully explained. Diagram shows dimensions. Specifications.

York Corp.

COMMUNICATION & SIGNAL EQUIPMENT

59—School Sound Systems

Brand new four-page brochure 8000 E-60 illustrates and describes all standard school sound systems. Covers equipment suitable for the smallest to the largest school units. Building block flexibility of console styles, panels and functions explained. Specification sheets furnished on request. Completely illustrated.

DuKane Corp.

60—Clock and Program Systems

Covers clock and program systems — two types include synchronous motor-powered secondary clocks, the other combining secondary clocks, minute-impulse type. Both have simplified programming, automatic resetting of secondary clocks. Bell control boards, various type signals, and clocks included.

Standard Electric Time Co.

61—Telephone Equipment

S. H. Couch Company's 12 page bulletin 128A includes wiring diagrams, specifications, and equipment data on U. S. approved mailboxes and apartment house telephone equipment. A variety of equipment is outlined to meet requirements of all types of apartment houses, both large and small. Completely illustrated.

S. H. Couch Co., Inc.

62—Annunciator Systems

Catalog 100C describes annunciator systems manufactured by Panalarm. The function, benefits, and selection of Panalarm annunciator systems are discussed. Included in this 50 page catalog are dimensions, plug-in relays, remote equipment and components, accessories, engineering data, and ordering information.

Panalarm, Division of Panellit, Inc.

63—Communication Systems

Catalog S-104R illustrates and describes 17 models, single channel to three channel communications systems. Both table top turrets and consoles with capacities from 22 to 180 rooms. Provisions included for telephone intercom, loudspeaker intercom, high fidelity FM-AM radio tuner, 3-speed transcription player.

Stromberg-Carlson, Special Products Div.

64—Apartment Telephone Systems

Bulletin ACAD, loose-leaf pages, describes two-way communication systems between apartments and the vestibule or lobby; also the house manager and trades entrance, if required. Cordless loudspeaking telephones throughout prevent theft and vandalism. Types of equipment pictured, wiring diagrams, specifications.

Auth Electric Co., Inc.

65—Audio Products Select-a-Guide

Radio Corporation of America offers in one package Select-a-Guides on Modular Sound Systems, Microphones, Amplifier Systems, and Loudspeakers. These fold-out easy-to-use folders illustrate, describe, and give specification data on the products. This is the first time this convenient package has been offered.

Radio Corporation of America.

66—Industrial Intercom Systems

Bulletin 2-1293 describes *Amplicall* industrial intercommunication and paging systems. Paging is done through a 30 watt amplifier to penetrate high noise levels. Twelve positions for intercom conversation. Operation is completely explained and cable requirements given. Includes pictures and specifications.

Rauland-Borg Corp.

67—*Stalpeth*-Sheathed Cables

Catalog T-9-60 covers the requirements for paper insulated, paired, exchange grade telephone cable with *Stalpeth* sheath. Paper insulated *Stalpeth* sheathed telephone cable is intended for aerial, duct and conduit installations. Some of these requirements include: insulation and belt, electrical, core, and material.

General Cable Corp.

68—Public Address Systems

New catalog SWC 17e/AL describes and shows examples of Altec's sound system building block flexibility. Each specialized component illustrated in the catalog is designed to work in complete harmony with every other item in the Altec line-microphones, amplifiers, preamplifiers, loudspeakers, and horns.

Altec Lansing Corp.

69—Master TV System Manual

Master TV manual written especially for engineers designing master antenna signal distribution. Shows components used in master TV systems, engineers' specifications, glossary of terms, charts, and tables. Section contains information on how to calculate electronic signal gains and losses. Wiring diagrams included.

Blonder-Tongue Laboratories, Inc.

70—Modern Signal Systems

A pocket size resume of all Edwards products for industrial and commercial applications. It fully describes the advantages and convenience of modern signaling, covering the full range from large control, communications and protection systems to single components. Various products pictured.

Edwards Co., Inc.

COMMUNICATION & SIGNAL EQUIPMENT *continued*

71—Hospital Signaling Equipment

Bulletin 137 includes wiring diagrams, specifications, and equipment data on visual paging, doctors register systems; and visual, psychopathic, manual and automatic audio-visual nurses call systems. The bulletin details one of the most complete lines of hospital signaling equipment. Components illustrated.

S. H. Couch Co., Inc.

72—Annunciator with Recorder

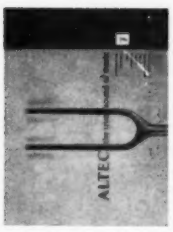
Bulletin 102A describes Panalarm's Model RA standard annunciator system with a highly accurate built-in automatic recorder. Gives a dependable, precise record of your equipment's operations. Advantages including exclusive features, and specifications. Photographs show installation, components, and operation.

Panalarm, Division of Panellit, Inc.

73—Clocks and Signals

New engineers' and architects' catalog contains general descriptions, illustrations, specifications, and complete details on time and program systems (electronic, synchronous wired, *Autoset* impulse); clocks (secondary, synchronous, wall, double-faced, tower, special designs); signal equipment.

Stromberg, Div. of General Time.



74—Stereo and Hi-Fi Music Systems

Altec's new catalog AL 1302-1 features illustrations of custom stereophonic and monophonic installations. A special feature is the selection which diagrams the proper placement of speakers and other components in a room. All components are described in detailed technical information and specifications.

Altec Lansing Corp.

75—Doctors' Register Systems

Brochure 22 describes the new *Dial-In* Doctors' In-and-Out Register System for large hospitals. The system permits inexpensive placement of registers at all doctors' entrances, eliminates space and wiring problems, reduces installation expense, and facilitates future expansion. For existing hospitals or new.

Auth Electric Co., Inc.

76—Indicating and Alarm System

Bulletin 3036C describes in detail the Edison *Omniguard* indicating and alarm system. A reliable, low-cost temperature detection for small or large installations. Features, operation, specifications, connections, wiring diagram, and installation procedures are given. Various types are pictured and described.

Thomas A. Edison Industries.

77—Language Laboratory Systems

A comprehensive language laboratory planning kit which includes a variety of aids for language laboratories. A series of equipment specification sheets contain general provisions, functions, equipment, and equipment specifications. Besides a general brochure there are a number of articles on language laboratories.

Radio Corporation of America.

78—Sound Specification Manual

Engineering specification manual, 65 pages, gives complete detailed specifications on central sound systems for schools, industry, and institutions. Single, dual, and three channel systems are fully outlined with typical systems specifications covering the entire equipment for modern sound coverage.

Rauland-Borg Corp.

79—Internal Telephone Systems

Catalog S-140 describes the benefits of a complete private internal telephone communications system. It points out profits, economy, and convenience offered by four Stromberg-Carlson switchboards with capacities from 10 to 74 lines. Four different type telephones either desk or wall are illustrated.

Stromberg-Carlson, Special Products Div.

80—*Alpeth*-Sheathed Telephone Cable

Catalog T-15-60 covers the requirements for fully coded even count, high molecular weight, virgin polyethylene insulated paired telephone cables with an *Alpeth* or *DS-Alpeth* sheath. Some of these requirements include: cable sizes, sheath materials, insulation and core tape, core construction, and electrical.

General Cable Corp.

81—Clock and Program Systems

Bulletin CL-572 describes the centrally controlled clock and program systems for schools, institutions, public buildings, and industry. Included is description of various systems with illustrated wiring diagrams. Features and applications of various types of clocks and audible signals are discussed. Specifications given.

Edwards Co., Inc.

82—Multiple TV Systems

Bulletin M-50-49 describes the Blonder-Tongue *Masterline* equipment for multiset operation in master and community TV systems. Consists of the main folder, an article on installing master TV systems in motels, catalog sheet of specifications, and price list. Bulletin is illustrated, includes amplifier specifications.

Blonder-Tongue Laboratories, Inc.

COMMUNICATION & SIGNAL EQUIPMENT *continued*

83—Closed Circuit TV

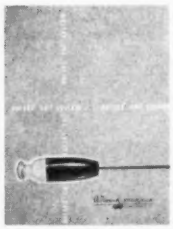
A new 9-page illustrated brochure, "What Every Businessman Should Know About Closed Circuit TV", explains industrial and commercial television in layman's language. Lightly written with a serious intent. Covers basic applications from hazardous viewing to bank administration.

GPL Division,
General Precision, Inc.

84—Plant Protection Systems

Folder PR32 illustrates and describes systems designed to supervise fire, watch, sprinkler systems, and production lines. Reports immediately to a control center by tape recorder (printed in English) giving time, location, and cause of signal. Electrically supervised. U.L. and F.M. approved.

Autocall Co.



85—Nurses' Call System

Bulletin shows latest Wheelock developments in nurse-patient communications systems. Descriptions of all system components are given. Booklet contains hospital floor plans, typical equipment layouts, and wiring diagrams. Explanation of operating procedure is included to illustrate the simplicity of the system.

Wheelock Signals, Inc.

86—Time Recording Systems

"First Quality for Timing Accuracy" contains general description of electronic, synchronous wired, and *Autoset* impulse time and program systems with illustrations of the master time control, secondary clocks, and signals. Also illustrated and described briefly are attendance time recorders, job cost recorders.

Stromberg, Div. of General Time.

ELECTRICAL APPARATUS

87—Aluminum Plug-In Busway

Bulletin GEA-6173 describes DE Aluminum Plug-in *Flex-A Power* Busway rated 225 to 1000 amperes. DE Busway is available in three-wire, three-phase and four-wire, three phase designs for maximum 600 volt applications. Bulletin includes weights, dimensions, ratings, applications, layout, and specifications.

General Electric Co.

88—Single and Multi-Speed Starters

Describes single and multi-speed starters, including combination and reversing starters, plus Square D *Spin Top* enclosures for hazardous locations. Also describes motor control racks for field mounting of *Spin Top* enclosures and other equipment. Bulletin includes price and dimension information.

Square D Co.

89—Low Voltage Circuit Breakers

Bulletin 4261-2B describes I-T-E's new *U-Re-Lites*, individually enclosed low voltage power circuit breakers. Information includes design, safety features, enclosure dimensions, selection chart, application data, and coil ratings. All features are illustrated photographically, as well as installation procedures.

I-T-E Circuit Breaker Co.

90—Assembled Switchgear

Bulletin 32-250 outlines indoor and outdoor assembled switchgear utilizing type DH De-ion drawout air circuit breakers. Contains switchgear engineering design features, outline dimension drawings, application data, and specifications. For commercial buildings, industrial plants, electric utilities and public works.

Westinghouse Electric Corp.

91—Synchronous Generators

High-speed synchronous generators, 30 to 300 kw, for standby and continuous applications, are described in bulletin 51B8909. Single-bearing, close-coupled units are available for direct connection to internal combustion engines; two-bearing units also available for belt drives or direct connection.

Allis-Chalmers.

92—Protective Relays

Bulletin 6200 describes Federal Pacific protective relays, designed to reduce maintenance, adjustment, and testing time. Open relay shows construction and components which are keyed to detailed explanation below. Each type of relay is illustrated and described. Complete specifications are given in table form.

Federal Pacific Electric Co.

ELECTRICAL APPARATUS *continued*

93—Electronic Cables

Bulletin DM-S-6015 describes the full line of Sequoia electronic cables, engineered for instrumentation, control, communications, and special applications such as extreme temperatures and radiation resistance. Available in a wide range of component materials, the cables are offered in many configurations.

Anaconda Wire & Cable Co.

94—Power Transformers

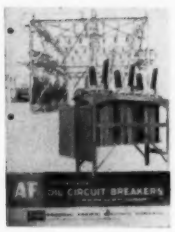
Booklet 7391 E describes in detail the 400 kV power transformers built by ASEA Electric. Booklet is a complete technical study of these transformers including charts, graphs, oscillograms, wiring diagrams, and line drawings. Completely illustrated with photographs including dramatic over-excitment tests.

ASEA Electric, Inc.

95—Protective Fuses

Bulletin HCS tells how Buss *Hi-Cap* fuses have unlimited interrupting capacity on any voltage up to 600 to provide safe protection for loads above 600 and up to 5000 amperes. Describes operating characteristics and advantages, illustrates dimensions, contains charts on current limiting effect and opening times.

Bussmann Mfg. Div., McGraw-Edison Co.



96—Oil Circuit Breakers

Bulletin 7213 describes Federal Pacific's AF frame-mounted oil circuit breakers. Line drawing shows construction of single pole units. Component parts as contact mechanism, interrupters, mechanical linkage, operating mechanism, construction, bushings, and transformers are completely illustrated and explained.

Federal Pacific Electric Co.

97—Full Voltage Motor Controls

Bulletin 269 describes a new line of synchronous motor controls. Designed for operation at voltages below 600 volts, the controls feature front accessibility, formed steel cubicles, and easy access. The controls are built to NEMA class A Rating, NEMA type 1 enclosure. Other NEMA types are available.

Electric Machinery Mfg. Co.

98—Dimmerboard Systems

This 24-page bulletin explains basic components of stage dimmerboard systems, as well as optional components and features. Complete description of standardized dimmerboards, plus convenient selection chart. Specifications for all types of dimmerboard systems and layout dimensions are included.

Square D Co.

99—Medium Transformers

Bulletin GEA-6984 describes the full line of transformers available from the Medium Transformer Department of the General Electric Co. Included are construction features, ratings, and application data. Various transformers are illustrated and installation procedures are pictured. GE features complete service.

General Electric Co.

100—Wiring Devices for Industry

Bulletin describes and illustrates many Arrow-Hart wiring devices used in industrial applications and includes supplementary information of interest. An up-to-date review of grounding requirements illustrates latest advances in this area and new types of grounding devices are discussed.

Arrow-Hart & Hegeman Electric Co.

101—Compact Unit Substations

Bulletin 5604-1A describes *Tranfo-Units* for indoor or outdoor, ratings 45 through 2500 kva, primary through 14.4 kv, secondary through 600 volts. These units, completely pre-engineered load centers for stepping down primary voltages, contain transformer and its primary and secondary distribution devices.

I-T-E Circuit Breaker Co.

102—Controlway Systems

Bulletin describes Cope *Controlway*, a low cost method of supporting low voltage control cables, signal cables, and instrument tubing. Advantages of *Controlway* are listed. *Controlway* is illustrated as are other Cope cable supporting systems. Complete line of system fittings meet exacting requirements.

T. J. Cope Div. of Rome Cable Corp.

103—Electrical Systems Design Book

Bulletin B7748 is for use by consulting engineers to prove that the best electrical system is the one which gives the greatest value per dollar of investment. Covers characteristics of good systems — flexibility, service continuity, voltage regulation, efficiency, operational cost, and maintenance. Helps in selection.

Westinghouse Electric Corp.

104—Motors and Generators

Bulletin 43-205 contains product information on high speed and low speed synchronous motors and generators. Looseleaf form, punched for three-ring binder. Gives information on low speed, high speed, and vertical-type construction, insulation, and exciters. All pages fully illustrated. Pictures of installations.

Electric Products Co.

ELECTRICAL APPARATUS *continued*

105—Stationary Batteries

Bulletin 4676 describes how best to install and operate Exide antimony alloy stationary batteries. Applies to recent EWA and FWA lines as well as to Exide-Manchex and Exide-Tytex types. Includes instructions for charging methods and operating rules.

Exide Industrial Division, Electric Storage Battery Co.

106—Open Dry-Type Transformers

Bulletin GEA-6668A fully describes General Electric's low-sound open dry-type transformers for industrial and commercial applications. Units are rated 300 kva and above, 601 to 15,000 volts. Advanced construction features are illustrated and electrical and mechanical characteristics charted. Installation data.

General Electric Co.

107—Motors, Generators, and Controls

Bulletin 100 traces the history of Ideal Electric and its products from 1903 to the present. Indicates types of equipment currently offered including large electric motors, generators, motor-generator sets, switchgear, and controls. Shows application to various phases of industry. Pictorial of progress in the power field.

Ideal Electric & Mfg. Co.

108—Aluminum Plug-In Duct

Bulletin SD-110 describes Square D aluminum plug-in duct with I-beam construction of bus bars. The 6-page, 2-color bulletin explains use of plug-in duct, tells why aluminum is used as a conductor. Includes convenient voltage drop curves, suggested specifications, and list of available accessories.

Square D Co.

109—Secondary Substations

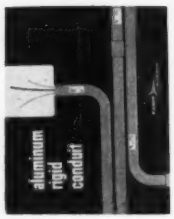
Bulletin 3104-1A supplies detailed information on secondary unit substations, complete and compact load distribution centers for indoor or outdoor application. Gives data and specifications on a large variety of primary devices, transformers, and secondary switchgear offered in I-T-E secondary unit substations.

I-T-E Circuit Breaker Co.

110—Standby Electric Plants

A guide to selection and installation of Onan standby electric plants and controls. Eight-page folder 32C/ON deals with need for standby power and choice of electric plant. Data on gasoline and diesel sets given in sizes up to 230kw. Automatic ac transfer controls are also described and illustrated.

D. W. Onan & Sons Inc.



111—Rigid Aluminum Conduit

Bulletin EC-885 describes Kaiser's rigid aluminum conduit. It is light weight, corrosion resistant, nonmagnetic, nonsparking, and easy to install. Standard installation procedures, dimensions, weights, and packaging details are given. Industrial applications are listed. Illustrated with photographs and diagrams.

Kaiser Aluminum & Chemical Sales, Inc.

112—Aluminum Conduit Fittings

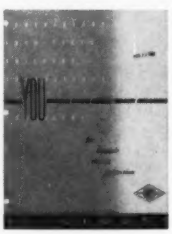
Catalog 59 lists, in condensed form, all types of aluminum conduit fittings made by Killark Electric Mfg. Co. Contains dimensional data of such items as circuit breakers, conduit bodies, connectors, explosion-proof vapor-tight and dust-tight fittings and fixtures. Catalog numbers keyed to separate price list.

Killark Electric Mfg. Co.

113—Building-Type Switchboards

Bulletin SA-8305 is designed to assist the consulting engineer in specifying building type switchboards. Includes layout data, dimensions, and specifications for Westinghouse switchboards designed for offices, commercial buildings, hotels, residences, schools, hospitals, stores, and institutional buildings.

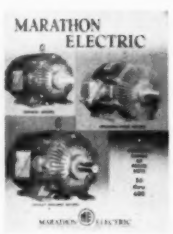
Westinghouse Electric Corp.



114—Circuit Breakers

"What You Should Know About Circuit Breakers for Branch Circuit Protection," 16-page manual 101, describes ways of protecting your client from fire, equipment damage, excessive wiring costs, and needless circuit interruptions. How hydraulic-magnetic circuit breakers provide this protection is pointed out.

Heinemann Electric Co.



115—Totally Enclosed Motors

Bulletin SB-185 describes Marathon chemical, and explosion-proof, totally enclosed electric motors. A wide range of sizes and designs with frames 56 through 680. Cutaway shows internal ventilating scheme. Components are shown and keyed to descriptions. Installation photographs of both types are included.

Marathon Electric Mfg. Corp.

116—Dual-Element Cartridge Fuses

Bulletin 1330 describes *Econ* dual-element cartridge fuses in designs to meet various circuit conditions. Cutaways show construction and components of ferrule type and knife blade type fuses. Line drawings show operation. Tables and charts complete technical data. Test report certified by ETL included.

Federal Pacific Electric Co.

ELECTRICAL APPARATUS *continued*

117—Fibre Conduit

Catalog 52 describes Orangeburg's standard and Nocrete conduit for installation with and without concrete encasement. Manufacturing methods, advantages, and properties given. Method of joining and tooling pictured and explained. Fittings of various kinds are diagrammed and dimensions given.

Orangeburg Manufacturing Co., Inc.

118—Electrical Fittings

Loose-leaf catalog 135 has been prepared to provide all the technical information you need to select the right conduit fittings, cable terminators, cast iron boxes, and solderless connectors for each of your electrical installations. It includes a comprehensive index and a section of useful engineering data.

O. Z. Electrical Mfg. Co.

119—"Rocker-Glo" Switches

Illustrated four-page brochure describes new *Rocker-Glo* switch by Pass and Seymour. It has a luminous button and operates silently. Available in 15 or 20 amp, 120/277 volts ac. It has easy-to-wire pressure or screw terminals. Comes in Despard type with strap or Despard interchangeable.

Pass & Seymour, Inc.

120—Switchboard Layout

This 72-page bulletin gives complete layout and specification information on Square D 14-in. switchboards. Separate sections on circuit breakers and fusible equipment for service and distribution systems. Contains detailed layout and dimension drawings, wire and conduit tables, and lists NEC requirements.

Square D Co.

121—Distribution Centers

Bulletin GEA-6928 describes GE's dry-type integral distribution centers featuring QHT transformers for applications up to 5000 volts. Installation instructions, features, dimensions and cable space, selection data, ratings, and panelboard components are included. Material specification form helps you specify.

General Electric Co.

122—Selecting High Voltage Fuses

Bulletin 265 gives directions for selecting S&C solid-material fuses for 23 to 138 kv systems. Fuse ratings range from 3E to 300E amperes. Method covers interrupting rating, ampere rating, coordination, pre-loading, ambient, cooling time, and overload operation. Reproducible time-current curves included.

S&C Electric Co.

123—Transformer Buyer's Guide

Bulletin 1047, Buyer's Guide, to help in specifying and ordering dry-type transformers. A quick and easy-to-use single source of specifying and ordering information. Pictorial index gives basic descriptions, application information, and page numbers on which prices, dimensions, and other data are found.

General Electric Co.

124—Automatic Circuit Recloser

Bulletin 1550C describes some new features of I-T-E's Type MB-2 automatic circuit recloser. Can be applied to 2.4 to 14.4 kv service in 70, 100, 140, 200, and 280 ampere ratings. Bulletin covers descriptive details, application, dimensions, specifications, and ordering data. Cutaways show construction.

I-T-E Circuit Breaker Co.

125—Lightweight Metallic Cable

Bulletin 1038 describes Simplex C-L-X, the lightweight, corrugated, impervious metallic cable sheath available in three new metals. Previously made of steel, C-L-X cable systems may now be ordered with copper, aluminum, or bronze flexible coverings. Advantages of the new metals are enumerated.

Simplex Wire & Cable Co.

126—Electrical Wiring Devices

Catalog 2-57 describes various wiring devices manufactured by the Slater Electric & Mfg. Co. Includes appliance switches, lampholders, power outlets, receptacles, switches, weatherproof devices, wall plates, and automatic *Kloz-A-Lite*. Loose leaf catalog consisting of numerous illustrated Slater bulletins.

Slater Electric & Mfg. Co., Inc.

127—Dry-Type Transformers

This bulletin 958A describes and illustrates Sorgel Electric Company's standard line of low sound level dry-type transformers in ratings of ¼ to 3333 kva single phase and 1 to 10,000 kva three phase, 120 to 15,000 volts suitable for varied installations. Consultants will find the book valuable.

Sorgel Electric Co.

128—Rotary Handle Circuit Breakers

Bulletin 1425 describes Federal's rotary handle circuit breakers for switchboards, control centers, panelboards, and individual enclosures. A complete line, 15 through 800 amps. Advantages listed and illustrated. Cutaway shows construction as well as component parts. Show space saved over conventional types.

Federal Pacific Electric Co.

ELECTRICAL APPARATUS *continued*

129—Polyphase Motors

Bulletin MU-232 describes protected, open frame, drip-proof motors 250 through 1000 hp available from Wagner Electric Corporation. These motors feature heavy fabricated steel frames with double end ventilation and can be furnished with either split-type sleeve bearings or heavy duty ball bearings.

Wagner Electric Corp.

130—Cellular Steel Floor Wiring

Bulletin C-17099 contains complete information on the General Electric *Cellular* steel floor wiring system. Complete description, photographs, and dimensional drawings of all components are included. Contains layout design information, suggested specifications, application data, and installation instructions.

General Electric Co.

131—Starters and Contactors

Engineers concerned with control will find reference book 14C9462 a quick guide for starters and contactors. Capsule descriptions are provided on a complete line of ac and dc, low and high voltage, air-break and oil-immersed contactors and controllers. Includes control centers, push-buttons, and switches.

Allis-Chalmers.

132—*Teflon* Wire and Cable

Bulletin DM-S-6001 describes a line of *Teflon* wire for hook-up of meters, panels, electrical, and electronic equipment and *Teflon* cable for high-frequency equipment and radio-frequency transmission lines in radar and communications systems. The products withstand −90° to 250°C.

Anaconda Wire & Cable Co.

133—Fuse-Fuseholder

New Buss fuse-fuseholder combination for protection of individual fluorescent fixtures and other equipment on circuits of 300 volts or less. Bulletin SFH-6 tells how individual fusing reduces hazards of fires and explosions. Bulletin specifies the size fuse to use and where to locate it for the best protection.

Bussmann Mfg. Div., McGraw-Edison Co.

134—Cable Support Systems

Catalog 1257 describes Cope cable supporting systems — cable trough, cable ladder, channel support systems, and accessories. Each type of cable support is explained and illustrated. Product identification line drawing keyed to index makes this loose-leaf catalog easy to use. Parts are illustrated. Available sizes.

T. J. Cope Div. of Rome Cable Corp.

135—Power Conversion System

Unified power conversion systems consisting of a semi-conductor rectifier, a transformer, and related components are described in I-T-E Bulletin 6101-1A. Bulletin gives construction, performance, design, and maintenance features of these high powered dc silicon-celled rectifiers, trade-named *Unitrons.*

I-T-E Circuit Breaker Co.

136—Magnetic Motor Controls

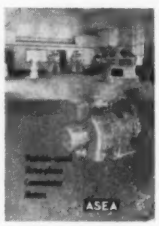
Bulletin A-262 explains why Arrow-Hart's Type RA magnetic motor controls offer of greatly reduced size and weight, without sacrificing performance and dependability. Open controls show construction and give dimensions. Important features and advantages outlined are illustrated with photographs and drawings.

Arrow-Hart & Hegeman Electric Co.

137—Pole-Type Capacitors

Bulletin 8145 and 8148 describe individual pole-type capacitors and capacitor assemblies. Cutaway shows construction and components of individual capacitor. Ratings and dimensions on both low and high voltage types. Line drawings with dimensions illustrate mounting brackets from single unit to six unit size.

Federal Pacific Electric Co.



138—Variable Speed Motors

Booklet 7315 Ea describes ASEA's variable-speed three-phase commutator motors. Booklet deals with design and mode of operation, components, basic principles, and characteristics. Various models are illustrated as well as control equipment. Industrial applications are outlined and actual installations pictured.

ASEA Electric, Inc.

139—Steel Underfloor Duct Systems

Bulletin C-7089 describes General Electric's three steel underfloor wiring systems. Complete product information, layout design data, and suggested specifications can be found on G-E's single-duct, and two-level duct systems. Photographs, and application data.

General Electric Co.

140—Heavy Duty Synchronous Motors

Bulletin 252 describes a line of bracket bearing type synchronous motors, 60 hp and larger. The motor line is available in either 1800 or 1500 rpm, 60 or 50 cycles, in all standard voltages, and either single or 2 bearing. The motors are available in most NEMA enclosures. Cutaway shows construction.

Electric Machinery Mfg. Co.

ELECTRICAL APPARATUS *continued*

141—Continuous Power Systems

Bulletin 21-200 describes the Inverter-Diverter, the continuous ac and dc power system. It supplies standby power instantaneously without losing even a fraction of a cycle. Includes features, construction, and operation. Oscillogram shows transfer from normal to emergency operation caused by 10% undervoltage.

Electric Products Co.

142—Stationary Battery Chargers

Bulletin 6256 contains technical data for selection and use of Exide constant-voltage, silicon-rectifier (UR) chargers for stationary batteries. Curves and statistics on charger performance at various electrical loads, diagrams and instructions for installing alarms and ground detection systems.

Exide Industrial Division.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

143—Squirrel Cage Induction Motors

Bulletin 201 covers Ideal Type "AP" squirrel cage induction motors rated from 25 to 1500 rpm and 514 to 1800 rpm designed for centrifugal blower, compressor, and pump applications. Complete performance data, emphasizing operating characteristics and construction features. Includes typical installation data.

Ideal Electric & Mfg. Co.

144—Portable Cords and Cables

Portable cords and cables are described in new manual KW-915. Book gives pertinent data on insulation compounds (*Laytex, Eonite, Kalzone*) and jacket compounds (neoprene and synthetic rubber). Various types of portable cords and cables are listed including specifications. Splicing, patching procedures.

Kaiser Aluminum & Chemical Sales, Inc.

145—Remote Control Motor Operators

Bulletin 5047-1A deals with I-T-E's exclusive *Telemand* motor operator for remote control of molded case circuit breakers. The device is a foolproof, compact and economical unit for opening, closing or resetting molded case circuit breakers by remote control. Will fit any I-T-E breaker in J-frame size or larger.

I-T-E Circuit Breaker Co.

146—Heavy Duty Safety Switches

New advances in safety switch design are described in Bulletin CPD-74, a 32-page illustrated booklet, which describes General Electric's new line of 30-600 ampere light and heavy duty safety switches. Featuring visible blades and quick-make, quick-break contacts, the switches are space savers.

General Electric Co.

147—Explosion-Proof Fittings

Catalog of aluminum explosion-proof fittings for hazardous locations. Included are junction boxes, conduit bodies, sealing fixtures, plugs and receptacles, pilot lights, switches, and fixtures. Complete dimensional data makes ordering easy. Special fittings made to order. Catalog numbers keyed to separate price list.

Killark Electric Mfg. Co.

148—Shallow Depth Switchboards

Bulletin 2015 describes shallow depth switchboards, a complete line of distribution switchboards through 2000 amps. Shows how you can add your choice of distribution sections or combined metering and distribution in a single section. Completely illustrated. Specifications included. Layout with dimensions.

Federal Pacific Electric Co.

149—Panelboard Circuit Breakers

Bulletin 3103 covers the Heinemann series 0911, an economical panelboard circuit breaker dimensionally interchangeable with other makes. Available in 1- and 2-pole models, 0.050 to 60 amperes, the 0911 uses hydraulic-magnetic actuation to end heat-induced nuisance tripping. Fast short-circuit interruption.

Heinemann Electric Co.

150—Synchronous Motors, Generators

Bulletin SB-154 describes Marathon Electric's sychronous high speed motors and generators. Typical construction features are listed and illustrated. Components shown. Application of Marathon synchronous generator matched to diesel engine with generator-mounted controls for minimum space requirements pictured.

Marathon Electric Mfg. Corp.

151—Molded Core Circuit Breakers

Bulletin GEA-6754 describes the General Electric line of molded case circuit breakers, 15 to 800 amperes, plus matching enclosures in flush, surface, raintype enclosures. Includes simplified guide to determine ampere rating of breakers for specific applications. Cutaway shows component parts.

General Electric Co.

ELECTRICAL APPARATUS *continued*

152—Power Circuit Breakers

Bulletin GEA-5915F describes G-E's stored energy low voltage power circuit breakers, manual and electrical, in ratings through 600 volts, 4000 amperes. Cutaways with keyed captions show components and construction. Ratings, operating currents, application tables, wiring diagrams, and dimensions.

General Electric Co., Apparatus Div.

153—Emergency Power Manual

Professional Manual SP1020 contains new specifications, price lists, technical bulletins and catalogs covering complete new line of Onan emergency generating plants up to 230kw. Includes gas, gasoline, and Diesel-driven units. New *Magneciter* generators described and *Instapac* inverter bulletin included.

D. W. Onan & Sons Inc.

154—Underfloor Duct Systems

Catalog 203 describes the Orangeburg underfloor duct system, non-metallic underfloor raceways for distribution of electrical wiring in commercial, industrial, and institutional buildings. Drawing keyed to index shows components, which are also pictured and described. Instructions for installation given.

Orangeburg Manufacturing Co., Inc.

155—Molded Case Circuit Breakers

Fundamentals of short-circuit protection for motor circuits in bulletin 5040-A which reviews the features and applications of ETI molded case breakers. Bulletin tabulates instantaneous trip range of ETI frame sizes and suggested trip setting positions for various horsepower motors.

I-T-E Circuit Breaker Co.

156—Terminating and Splicing Fittings

"O.Z. Terminating and Splicing Fittings for Interlocked Armor Cable," 36-page engineering bulletin 135A, gives complete specifications, dimensions, cutaway drawings, photographs, and installation instructions. Prices and weights also are given for each item, along with ordering data and available materials.

O. Z. Electrical Mfg. Co.

157—Control Centers

Control Centers in three construction types, NEMA Type "A", "B", and "C" are explained in bulletin B-6722. Information charts on short circuit protection, control center arrangements, selection of starter sizes and starter components, application and engineering data, dimension and circuit diagrams.

Westinghouse Electric Corp.

158—Electrical Wiring Devices

Catalog 60, 75 illustrated pages, describes complete range of electrical wiring devices. Both the interchangeable Despard line and the P&S conventional line. Everything from switches to fixtures to devices for every purpose are listed. A 15-page index and price list are also included in this catalog.

Pass & Seymour, Inc.

159—Metalclad Switchgear

New brochure describes components, applications, and performance of metal-clad switchgear, ratings to 500 MVA short circuit interrupting and 44,500 amp fault closing. Drawings show substation, switching center, and service entrance applications. Typical installations and construction shown.

S & C Electric Co.

160—Electrical Equipment Manual

New 20-page manual gives comprehensive specification data on Square D electrical equipment – safety switches, panelboards, switchboards, dimmerboards, control centers, bus duct, and substations. The manual also includes convenient reference guide to National Electric Code requirements.

Square D Co.

161—Cables for Power Circuits

Bulletin 1037 describes Simplex *Anhydroprene XX* cables for power circuits up to 600 volts, designed for service in ducts or conduits or as open wiring in buildings. The jacket is a balanced compound of neoprene and other ingredients which provides balanced resistance to sunlight, oil, acids, heat, flame, abrasion.

Simplex Wire & Cable Co.

162—Substation Transformers

Bulletin describes the rugged and soundly built Federal Pacific transformers. Illustrated are all types of liquid filled unit substation transformers as well as the conventional pole mounted distribution transformers. Typical installations of the various transformers are shown in pictures. Complete technical data.

Federal Pacific Electric Co.

163—*Hi-Lo* Dimswitches

Bulletin describes the Slater *Hi-Lo* dimswitches. This switch will replace any existing switch for incandescent lamps. Fits any standard switch box. No rewiring necessary. In low position gives 30% of light. Increases life of bulb; saves electricity. Types of plates available are shown. Wiring diagrams.

Slater Electric & Mfg. Co., Inc.

ELECTRICAL APPARATUS *continued*

164—Transformers and Substations

Bulletin 655 describes Sorgel's load center transformers and substations in capacities up to 3000 kva and voltages up to 15,000 volts. Includes information on application, sizes, types, and construction. Advantages are listed and all units are illustrated. Old way of power distribution is compared to new way.

Sorgel Electric Co.

165—Automatic Transfer Switches

Newly revised Catalog 57-S1R1 provides complete information (including pricing) on mechanically and magnetically held automatic transfer switches. Information on selection, design and application data, Blackout Control Systems, 16 Accessory Features. Photographs show construction details. Also includes wiring diagrams.

Automatic Switch Co.

166—Emergency Power Guide

Booklet 40-20205-DN927 is Caterpillar's guide book for emergency power. Describes in detail the three sources of standby power — central battery systems, two circuit systems, and emergency generator sets. Details many advantages of diesel generator sets. Selection data of proper diesel for specific application.

Caterpillar Tractor Co., Engine Division.

167—Pad-Mounted Transformers

Bulletin TU-148 describes new pad-mounted *Sub-Urban* distribution transformers manufactured by Wagner Electric Corporation in single-phase ratings 25 through 167 kva, and in three-phase ratings 75 through 500 kva. Units can be screened by shrubbery to blend into the architecture.

Wagner Electric Corp.

168—D-C Circuit Breakers

Four-page bulletin 4601-1A contains descriptive and technical information on the I-T-E line of FB dc current-limiting circuit breakers. Wiring diagrams, line drawings, weight and dimensions charts and application suggestions included. Photographic illustrations show types of equipment and components.

I-T-E Circuit Breaker Co.

169—Electric Plants

Catalog KEP56-1, 24 pages, shows the line of Kohler electric plants used as an independent source of electricity for sole supply and for automatic standby when central station power fails. Sizes range from 500 w to 100 kw, gasoline and diesel. Battery charging units in 6, 12, 36, and 140 v capacity are described.

Kohler Co.

170—Load-Center Unit Substations

Bulletin GEA3592L describes G-E's load-center unit substations with AKD switchgear. Bulletin contains complete information including diagrams, time-current curves, circuit diagrams, application tables, selection data, dimensions, and guide form specifications. Photographs cover installations and components.

General Electric Co., Apparatus Div.

171—Explosion-Proof Receptacles

Bulletin CES-660 has been designed to provide you with information on all the latest improvements in Appleton's streamlined *Arc-Loc* "CES" and "CESD" Receptacles and "CPH" Plugs. Specifically for application in hazardous areas such as refineries, chemical plants, paint plants, fuel storage, and others.

Appleton Electric Co.

172—Cable Support Systems

Catalog 103 describes Chalfont cable support systems. Chalfont cable trays, racks, and troughs are designed as the most economical and efficient method of support electrical armored cable, low voltage control cables, and process tubing. Made of aluminum, galvanized steel, or aluminized steel.

Chalfont Products Co.

173—Duct Floors for Electrification

Sixteen-page booklet, "Electrical Outlets Wherever You Need Them," gives complete details on RLC duct floors, a new development which provides 100 percent electrical flexibility for buildings at a remarkably low cost. The illustrated booklet is published by the Concrete Steel Reinforcing Institute.

Concrete Steel Reinforcing Institute.

174—Wire and Cable

Composite specification sheets contain simplified technical information for the users of electrical wires and cables. Includes specification data sheet, dimensional chart, weight and packaging chart, and price list. Four sheets contain all the information necessary for those who deal in electrical wire and cable.

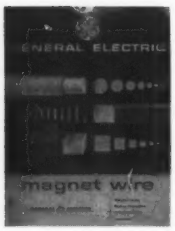
Hatfield Wire & Cable Division.

175—Drawout Metal-Clad Switchgear

Bulletin 3-450 describes Federal Pacific's Type DST 5-350 and DST 15-1000 drawout metal-clad switchgear. Cutaway shows construction details with various important points keyed to text. Outstanding features are illustrated. Interior of metal-clad housing is shown with features keyed to text. Dimensions given.

Federal Pacific Electric Co.

ELECTRICAL APPARATUS *continued*



176—Magnetic Wire

Bulletin WC-8289 describes all types of magnetic wire produced by the General Electric Company. Includes selection guide, product description, dimensional data, and application information. Various types of insulation are discussed. Maximum outside diameters in table form. Illustrations show types of wire.

General Electric Co.

177—PVC Rigid Conduit

Bulletin KE 1058 is a new 20-page rigid polyvinyl chloride electrical conduit catalog. Included are comprehensive test results, specification information, installation instruction, corrosion resistant charts, and other valuable data. Illustrations show various types of pipe and fittings. Pictures show proper assembly.

Kraloy Plastic Pipe Co., Inc.

178—Bus Duct Layout

Booklet B-4272-D is designed for consultants' use in planning and selection of units for bus duct layout in commercial, institutional, and industrial buildings. Plugin duct, outdoor feeder duct, low-impedance duct, and *Life-line Busway* are fully covered. Completely illustrated with engineering and test data.

Westinghouse Electric Corp.

179—Power Circuit Transformers

Bulletin P571-15 describes Jefferson's power circuit transformers, the economical, efficient approach to better power distribution. Line drawings combined with tables give all dimensional data. Application data includes selection, mounting, and conversion. Also given are wiring diagrams and specifications.

Jefferson Electric Co.

180—Vertical Break Switch

Bulletin describes the Delta-Star MK-40 vertical break switch. Only three moving parts, links, levers, and braids eliminated. Outstanding features pointed out in keyed photograph. Various other switches are illustrated and application information is included.

Delta-Star Electric Division,
H. K. Porter Co., Inc.

181—Power Control Centers

Catalog SM-244, 16 pages, describes in detail the modern method for centralizing electrical power distribution and motor control equipment for industrial applications. It also contains suggested ideas for control specifications, and gives a simplified selector for use in control center layout and planning.

Square D Co.

182—Varidrive Motors

Bulletin F-1797, "Variable RPM's Control Production Tempo – U. S. Varidrive, the Miracle Motor," 16 pages, full color, describes combined motor and integral V-belt drives providing stepless speed changes 2 to 10,000 rpm, ¼ to 75 hp. Space-saving, vertical or horizontal in many models.

U. S. Electrical Motors, Inc.

183—Insulated Wire and Cable

Everything needed for the selection, design, installation, and operation of Kerite insulated wire and cable for light, power, and control service. Leatherette portfolio is tab-indexed to cover cable description, capacity, testing, technical tables, terminals, splices, and miscellaneous data of value to the consulting engineer.

Kerite Co.

184—New Metal-Clad Switchgear

New I-T-E 4160-volt stored energy metal-clad switchgear described in bulletin 2801-1A. Newly-designed equipment, smaller in every exterior dimension, offers spring-powered stored energy closing in a completely new metal-clad gear design; provides new convenience and safety. Illustrations and charts.

I-T-E Circuit Breaker Co.

185—Motor Starter Panelboards

Bulletin GEA-6728 describes a new line of distribution panelboards with magnetic motor starters combined with related circuit breakers or fusible protective devices in one enclosure. The equipment is rated 600 volts ac maximum. Magnetic starters are used in NEMA Sizes #0 through #3.

General Electric Co.

186—Automatic Transfer Switches

Bulletin IR-0033 on Zenith transfer switches in emergency power systems. Describes switches mechanically held in normal and emergency positions, mechanically held in one position and electrically held in other, magnetically or electrically held in both. Also details and diagrams on designing systems.

Zenith Electric Co.

187—Flame-Retardent Polyethylene

Technical bulletin RCT-710 deals with the historical development, flammability of polyethylene compositions, physical and electrical test data, properties, electrical characteristics, and processing of flame-retardent Polyethylene for wires and cables. Included are tabular data, bibliography, specifications, and charts.

Rome Cable Corp.

ENGINEERS' OFFICE & FIELD EQUIPMENT

188—Electronic Computing System

Complete specifications on the new RPC-4000 electronic computing system are given in brochure S-483. The RPC-4000 is a fully transistorized, electronic stored program, general purpose computing system, for both engineering and business data processing. System is modular and offers complete flexibility.

Royal McBee Corp.

189—Revolute's Reducing Printer

Revolute's Reducing Printer, reduces large prints ⅓ to ¼ for convenience and economy, while retaining enough dimension to read print detail. Lockheed Aircraft, described in bulletin A2678, reduces their full-size drawings up to 42" to half-size 21" prints for distribution. Includes photographs and diagrams.

Charles Bruning Co., Inc.

190—Tabular Display

Bulletin 1006 describes GPL's *Tabtrol*, a tabular display capable of hard copy display, printing, or revision; binary input, storage, and output; electronic data scanning and identification. Used in traffic coordination, industrial processing, automated order filling, broadcasting.

GPL Division,
General Precision, Inc.

191—Print Making Problems

Catalog SPD2 illustrates and describes actual case histories of specific drafting and print making problems that have been solved by the use of certain advanced techniques and products that have been developed by Eugene Dietzgen Company. This well illustrated booklet outlines problems and solutions.

Eugene Dietzgen Co.

192—Dictating-Transcribing Machine

Bulletin AD-577 describes DeJur-Amsco's versatile dictating-transcribing machine. This compact, economical, fully transistorized Stenorette-T is engineered for dependable service. Full color folder shows unit with features detailed and illustrated. Included is the Stenorette companion, a portable counterpart.

DeJur-Amsco Corp.

193—Microfilming Systems

A presentation of modern microfilming in booklet form by Recordak, the originator of modern microfilming. Explains the system in precise form. Shows sample films of the various steps in recording a specific engineering drawing. Finally reproductions of the film printed on opaque and translucent vellum stock.

Recordak Corp.

194—Portable Microfilmer

Bulletin A-948 describes the new Recordak portable microfilmer. Illustrated in full color, this six page folder explains and illustrates the outstanding features. This portable microfilmer weighs less than an office typewriter, 24 lbs, and measures 6½" x 15½" x 12½". Fits compactly into a handy carrying case.

Recordak Corp.

195—Earth Excavation Computator

Manual E26-1516 describes the problem of computing earth excavation and embankment volumes for highway design, using the solid-state IBM 609 calculator. In addition to formulas and program, materials included are input and output cards and survey data sheets. Charts and graphs are included.

International Business Machines Corp.

196—Steno-Sheet Dictating Machine

Bulletin AD-504 describes DeJur-Amsco's magnetic *Steno-Sheet* recording medium. The most advanced dictating-transcribing system ever created. Dictation is recorded on an erasable, reusable magnetic sheet of indestructible polyester film. Steno-Sheet can be clipped to collateral correspondence.

DeJur-Amsco Corp.

197—Bruning Copyflex

Bulletin 2720 describes the Bruning *Copyflex* Model 300 white printer with a 39" printing width. The compact "300" provides exceptional print quality at a cost of little more than a penny per square foot. Brochure includes complete specifications and installation data. Series of photographs show operation.

Charles Bruning Co., Inc.

198—Electronic Digital Computer

Brochure S-526R1 describes the Royal Precision LGP-30, a desk-sized, stored-program, general purpose electronic digital computer. Specifications and features are listed and illustrated. New optional photo-electric punched tape reader and high-speed punch unit illustrated. Components described and pictured.

Royal McBee Corp.

199—Data Processing System

Booklet 520 introduces the desk-sized IBM 1620, designed primarily to process research and engineering problems. Speed and capabilities are listed together with the advantages to be derived from this advanced storage and computing system. Programming systems available for use with the 1620 are shown.

International Business Machines Corp.

FIRE PROTECTION EQUIPMENT

200—Fire Alarm Systems

Catalog illustrates and describes Standard's March Time, Master Code, and Box Code systems. Also covered are supplemental pre-signal circuits, non-code continuous sounding bells and horns, code transmitters, control panels, stations, detectors, signals, and accessories. Specifications included.

Standard Electric Time Co.

203—Remote Fire Alarm System

Bulletin A-1-857 describes how Autocall's remote fire alarm system connects the protected area with the fire station for positive continuous protection 24 hours a day. Fully supervised electrically, no false alarms, foolproof. Wiring diagrams. Approved by U.L. and F.M. Offices in principal cities.

Autocall Co.

201—Fire Hydrants

An AWWA compression type, dry head fire hydrant with swivel flange below nozzles permitting nozzle section to be rotated 360° without removing bolts. Outer protection case permits removal of complete barrel for replacement or repairs without excavating. Bell, mechanical joint or flange pipe connections.

R. D. Wood Co.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

202—Fire Alarm Systems

File folder describes code and non-code fire alarm systems for schools, hospitals, institutions, and industrial buildings. Typical specifications and installation diagrams are given for general alarm, continuous ring, presignal alarm, master-code, march-time. Supervisory feature of Wheelock fire alarms explained.

Wheelock Signals, Inc.

204—Interior Fire Equipment

Catalog covers all types of fire protection equipment with technical data and art: sprinkler, CO_2, dry chemical, and foam systems; smoke detecting and alarm systems; hose racks and cabinets; hose, nozzles, and fittings; various types of portable extinguishers. Nine famous brands, 1200 products, from one source.

Fyr-Fyter Co.

HEAT EXCHANGERS & WATER HEATERS

205—Gas-Fired Water Heating Systems

A Guide to the proper sizing, selection, and installation of gas-fired water heating systems for all types of restaurants and cafeterias. Various types of dish-washing equipment are described. Basic information is furnished on water and gas piping, venting, and required clearances. Diagrams and cutaways.

American Gas Association.

207—New Water Heating Guide

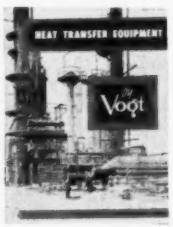
Concerned with the problem of furnishing hot water for large buildings? Write for a copy of booklet TH-160 on indirect type instantaneous water heaters, their application, selection, and installation. Indirect type water heaters obtain heat from the same hot water or steam boiler that furnishes heat for the building.

Bell & Gossett Co.

206—Heat Exchanger Manual

This catalog contains an engineering section that provides the engineer with the means to make size estimates of heat transfer equipment. It helps the engineer to select a heat exchanger that will provide economy of service, precise operation, and long life. Contains thermal standards and reference data.

Condenser Service & Engrg. Co., Inc.



208—Heat Transfer Equipment

Bulletin HE-8 describes the wide range of heat transfer equipment built by Vogt. Standard and custom built types from steel, alloys, or nonferrous materials for every temperature, pressure, or vacuum service. Conforms to all codes. Features of design shown for each type of heat exchanger. Fully illustrated.

Henry Vogt Machine Co.

HEATING & VENTILATING EQUIPMENT

209—Cast Iron Gas Boilers

Bulletin C-297, describes the Weil-McLain Type J cast iron gas-fired boiler, with a net capacity from 360 mbh to 3,354 mbh (14.3 hp to 129.1 hp) Approved by A.G.A.; ratings approved by Institute of Boiler and Radiator Manufacturers. Construction, control, dual fuel features, ratings and dimensions.

Weil-McLain Co.

210—Platecoil

This bulletin, 59-PI, describes and illustrates the new Platecoil configuration. It contains pertinent information on construction, application, and advantages in heat transfer. Specifications, size, weight, and surface area of standard units are listed. Varied applications are pictured and discussed.

Tranter Manufacturing Co.

211—Power Roof Ventilators

Bulletin 680-C describes Sky-Blast power roof ventilators. Weatherproof features include corrosion-proof, aluminum alloy propeller; nonclogging dampers and rain-shed; one-piece all welded base hot-dip galvanized after fabrication. Automatic fire-vent release. Sizes to 60 inches; air deliveries to 78,000 cfm.

Robbins & Myers, Inc.

212—Quiet Operating Fans

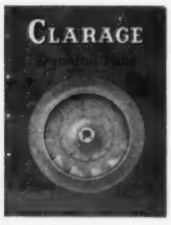
The *AcoustaFan*, which features a *Flow-Nozzle* air foil wheel designed specifically for quiet operation, is described in Bulletin 592. Quiet zone selection tables make an automatic selection of the quietest possible fan. Capacities range from 6000 cfm to 220,000 cfm, static pressure 3 in. wg through 11 in. wg.

New York Blower Co.

213—Electric Cabinet Heaters

Bulletin 403 presents complete details on Nesbitt cabinet heaters for electric heating. Designed for maximum flexibility of arrangement and operation these electric units are available for floor, ceiling, wall or inverted mounting. For nonrecessed, semi-recessed, fully recessed or concealed installations.

John J. Nesbitt, Inc.



214—Airfoil Blade Fans

Catalog 859 describes a new line of highly efficient, quiet airfoil blade fans. Dynafoil fans are particularly applicable to mechanical draft and heavy duty applications, such as industrial processes, conduit air conditioning, and tunnel ventilation. Various arrangements and panel openings pictured. Dimensions given.

Clarage Fan Co.

215—Gravity Roof Ventilators

Bulletin AEG-60 gives engineering data for quick, easy selection of square and rectangular size gravity roof ventilators. Extensive charts from 500 to 40,000 cfm and static pressure losses for discharge or relief units are explained and diagrammed. Intake velocities from 1500 to 35,000 cfm included. Detail drawings.

Penn Ventilator Co., Inc.

216—School Heating and Ventilating

Bulletin CC-601 provides school heating, cooling, and ventilating information, especially application of Lennox Comfort Curtain system. Covers research and air distribution, heat gain and loss. Heat source of warm air, hot water, steam, electricity, heat pump; use of outdoor air and mechanical cooling.

Lennox Industries Inc.

217—Compact-Type Steel Boilers

Catalog SB107 gives new SBI ratings and engineering details on the Burnham *Compact-Type* steel boiler. Designed to compress maximum heating capacity into minimum floor space. It is available for oil, gas, and coal firing. Capacities from 2,930 to 39,370 sq ft SBI net steam EDR new ratings.

Burnham Corp., Steel Boiler Department.

218—Attic Fans

Bulletin A114 describes Ventura attic fans manufactured by American-Standard. Available in eleven sizes, capacity ranges from 4400 cfm to 21,500 cfm. Advantages and selection procedures are outlined. Various models are pictured. Bulletin includes capacity ranges, dimensions, and installation layouts.

American-Standard Industrial Division.

219—Power Ventilators

Designed to serve with equal efficiency as exhaust or fresh air supply units, Burt low type power ventilators are detailed in bulletin SPV-16. Structural, design, dimension, and performance data are included for these high capacity, low profile ventilators. Available with either direct motor driven fan or belt drive.

Burt Manufacturing Co.

220—Direct-Connected Vaneaxial Fans

Bulletin 475 covers new Aerovent direct-connected vaneaxial fans, equipped with removable vane sections to facilitate installation and simplify routine cleaning and maintenance. Furnished in sizes 18″ to 48″ for capacities to 67,300 cfm, these high-efficiency units offer top performance against resistances to 6″ SP.

Aerovent Fan Co., Inc.

HEATING & VENTILATING EQUIPMENT *continued*

221—Low Level Roof Ventilators

Bulletin 609 covers new Aerovent *Sil-low-et* roof ventilators designed to provide the lateral-look for commercial and public buildings and industrial plant and office structures. Furnished in sizes 12″ to 48″ in belted and direct-connected models for capacities to 35,900 cfm at external resistances of ⅛″ to ⅜″ SP.

Aerovent Fan Co., Inc.

222—Square-Heat Packaged Boilers

Bulletin 1145 covers the new line of Kewanee square-heat forced draft packaged units in 12 sizes ranging from 9 hp to 54 hp. Equipped for light oil, gas or combination firing. Shipped completely assembled and jacketed. Bulletin gives complete selection data and engineering specifications. Illustrated.

American-Standard Industrial Division.

223—Exhaust Fan Ventilators

Bulletin SPV-18 details Burt free exhaust fan ventilators, designed for extremely fast removal of contaminated air. Air-shaft dampers open automatically to vertically exhaust an unrestricted column of air, and close to thoroughly weatherproof unit when motor is shut down. Capacities are available to 75,550 cfm.

Burt Manufacturing Co.

224—Ready-To-Run Fan Sets

Catalog 517 describes a new line of V-belt driven *Ready Units*. Features of construction and available special features are outlined. Selector charts indicating volumes to 25,000 cfm and static pressures to 2½ in. are shown in charts and graphs. Dimensions, capacities, shipping weights, and motor limits included.

Clarage Fan Co.

225—Applying Industrial Heaters

Bulletin IND-591 supplies all needed data to design industrial heating jobs using direct-fired heaters (with heat exchangers). It has definitions, heat loss calculations, nozzle and duct air distribution, single and multiple installations, door heating, process heating, make-up air, controls, fuel piping, and usage.

Lennox Industries Inc.

226—Scotch-Type Packaged Boilers

Modern scotch-type 3-pass design gives these boilers certified efficiencies of over 80%. Flue gas temperatures in the 400° to 450° range, 20 to 800 hp, and new SBI 5 sq ft per hp fireside heating surface ratings. Designed for oil, gas or oil/gas firing. Shipped in single units or boiler-burner packages.

Burnham Corp., Steel Boiler Department.

227—Steam Distributing Tube Service

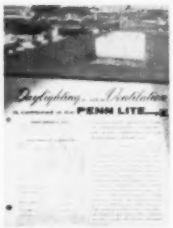
Bulletin 345-1 reports test results which document ability of Nesbitt steam distributing tube surface to provide uniform final temperatures and maximum freeze protection over entire capacity range. Test set-up described and performance data presented graphically. Operational characteristics defined.

John J. Nesbitt, Inc.

228—Heavy Duty Fans

Heavy duty industrial IPL fans that range in capacity from 4000 cfm through 154,000 cfm with static pressures to 12″ wg are described in Bulletin 572. Sturdy all-welded construction and easy maintenance features make these fans ideally suited to severe industrial air moving applications. Illustrated.

New York Blower Co.



229—Gravity Ventilators

Bulletin LTX-59, a supplement sheet to bulletin LX-59C, provides detailed information for low silhouette gravity exhausters with translucent fibreglass dampers and weather caps. Light values of illuminations are presented in table form. Drawings, units, dimensions, gauges, and weights are included.

Penn Ventilator Co., Inc.

230—Heavy Oil Boiler-Burner Units

Bulletin C-272 describes the first cast iron boiler-burner units for No. 5 oil, and combination gas/light oil for commercial and industrial heating systems. Capacity range from 814 mbh to 2,942 mbh (32.4 to 113.2 hp). Includes construction and control features, ratings, dimensions, and other data.

Weil-McLain Co.

231—Belt-Driven Tubeaxial Fans

Bulletin 625, eight pages, describes Type BT and BTV tubeaxial fans in 30 to 60 inch sizes. Designed for handling high temperatures, corrosive and explosive fumes, abrasive dusts, dirt laden air, high humidity. Also lists general fan laws, data on system and open surface tank ventilation, and duct resistance.

Robbins & Myers, Inc., Propellair Div.

232—Multi-Zone Platecoil

Bulletin 159, 48 pages, completely describes new Multi-Zone Platecoil, covering styles, dimensions, specifications, and operational data. Methods of calculating heat transfer equipment requirements are outlined. Typical installations are pictured and described. Available on request.

Tranter Manufacturing Inc.

HEATING & VENTILATING EQUIPMENT *continued*

233—Convector Radiators

Catalog 4059 illustrates and fully describes how modern design and engineered heating efficiency combine to make Young convector radiators ideal for steam or hot water heating systems. Technical data, general application photos, construction features, steam and hot water capacities, dimensional data.

Young Radiator Co.

234—Impulse Steam Traps

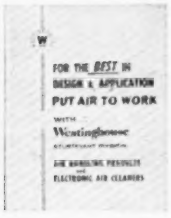
Bulletin T-1743 describes impulse steam traps for every trapping need. Indicates proper traps for normal requirements, high pressures, light loads, and extra heavy loads. Gives materials, capacities, dimensions, prices, and other pertinent information. Explains advantages of this type of trap for various services.

Yarnall-Waring Co.

235—Copper-Alloyed Galvanized Steel

Bulletin WC-255 describes the ultimate in galvanized sheets for air conditioning ducts and other applications, *SofTite Cop-R-Loy* galvanized sheets. Description of product, how and where it has been used, its manufacturing process, and other subjects are covered in detail with words and photographs.

Wheeling Corrugating Co.



236—Air Handling Products

Bulletin B-5188S offers Westinghouse Sturtevant line of air handling products and electronic air cleaners. Apparatus listed for heating and ventilating, industrial processing, cooling and dehumidifying, and electronic air cleaning. All equipment is illustrated photographically.

Westinghouse Electric Corp., Sturtevant Division.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

237—Surface Unit Heaters

Catalog 956 describes *Grid* cast iron steam heat transfer surface unit heaters, blast heaters, and radiators. Describes and illustrates one-piece construction. Included are air distribution charts, heating capacities, conversion tables, and specifications. This four-section catalog with tab index is well illustrated.

D. J. Murray Manufacturing Co.

238—Industrial Space Heaters

Twelve-page bulletin describes OG-581 new design space heater. Gas, oil, or combination dual fuel burners with push-button changeover. Output from 280,000 Btuh on up. Rugged construction with completely enclosed burner adaptable for space heating, ventilation, make-up air, process heating, air conditioning.

Lennox Industries Inc.

239—Air Handling Sound Traps

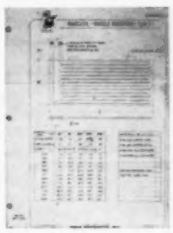
Catalog 464-M76 describes Kopper's complete line of Aircoustat sound traps for use in air handling systems. Drawings show system with individual details of components. Three steps in proper selection are given in detail. Airflow tables for single and multiple units included. Suggested installation methods.

Koppers Co., Inc.

240—Heating Ducts and Ventilators

Catalog 300 is the master catalog of *Milcor* sheet metal products. It presents detailed descriptions, installation information, sizes, weights, and packing on *Milcor* heating and air conditioning products, *Milcor* ventilators, *Milcor* roof drainage products and *Milcor* building specialties.

Inland Steel Products Co.



241—Panelcoil Data Sheets

Panelcoil data sheets series 28 through 59 give complete engineering specification tables on complete Dean line of single and double embossed *Panelcoils*. Use with bulletin 259, showing heating and cooling application data and prices. Superior *Panelcoil* takes the place of pipe coils and tubing.

Dean Products, Inc.

242—Controlled Ventilation

Catalog G-59-A describes controlled ventilation assuring the right ventilator for every job. This catalog provides a carefully developed guide to help consulting engineers determine exact ventilation equipment best suited for specific needs. Includes dimension, performance, and capacity charts. Illustrated.

Loren Cook Co.

243—Counterflo Space Heaters

Bulletin 580-12 describes Dravo's industrial counterflo space heater. Designed for comfort heating, ventilating, process drying, wake-up air, and heat curing. Upright, inverted, and horizontal models diagramed. Included are dimensions, engineering data, and specifications. Cutaway shows construction.

Dravo Corp.

HEATING & VENTILATING EQUIPMENT *continued*

244—Large Volume Ventilators

Catalog 575 describes McQuay's *Seasonvent* volume ventilator suitable for all heating and ventilating applications. Various arrangements are diagramed and applications pictured. Includes complete selection data, dimensional data, accessories and engineering specifications. Cutaway shows construction and operation.

McQuay Inc.

245—Bifurcator Fans

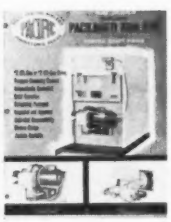
Catalog DB-37-55, 16 pages, describes operation of the bifurcator fan, a split-housing fan that exhausts hot, corrosive, and flammable fumes. Use of the bulletin makes fan selection easy since it gives full data on fan laws and static pressure, velocity pressure, and friction.

DeBothezat Fans, Division of American Machine & Metals, Inc.

246—Heating-Ventilating Cabinets

Bulletin UH-130 gives complete description on heating and/or ventilating cabinets. Type HV is for both heating and ventilating in horizontal or vertical operation. Type V is for ventilating only. Information includes unit arrangements, physical data, weights, fan performance, dimensions, and coil ratings.

Buffalo Forge Co.



247—Baseless Packaged Boilers

Bulletin ADJ-0025 describes "FCB" Series forced draft packaged boilers which are factory assembled, SBI Table 3 units for oil, gas, or combination fuels. They feature integral skid type base, refractory base, low water line, low smoke outlet, and factory wiring with a full complement of safety controls.

Crane Co.

248—Air Diffusers

Bulletin K27-A illustrates and describes linear and rectangular series air diffusers. Offered in three series — square, panel, long-slotted – units combine best air distribution and modern styling. Dimensional drawings for several types in each series provided. Complete selection and performance data, list of agents.

Connor Engineering Corp.

249—Radiant Panel Heating

"Radiant Panel Heating with Steel Pipe," 48 pages, covers the history of this type of heating, basic design, floor, ceiling, and wall panels, information on snow melting systems, pipe coil integration, design of a floor coil system, and a boiler hook-up diagram.

Committee on Steel Pipe Research, American Iron and Steel Institute.

250—Roof Exhausters

Bulletin 100-1959 describes Ammerman's PB and BCD *AirXpeler* power roof exhausters fabricated of aluminum or molded reinforced fibreglass. Offered in a large variety of sizes and speeds. Gravity or fresh air intakes available. Catalog illustrated with photographs and diagrams. Complete specifications.

Ammerman Co., Inc.

251—Heavy Duty Heating Coils

Bulletin B-1518 presents the first complete line of heavy duty heating coils designed and built to meet the rigors of industrial service. Advantages, materials, and construction outlined. Each type of coil is illustrated and specifications are shown in chart and diagram. Selection data in charts, graphs and diagrams.

American-Standard Industrial Division.

HIGHWAY, BRIDGE & STREET MATERIALS

252—Suspension Bridge Data

Catalog D-943 contains technical data making possible preliminary calculations for comparative estimates between the suspension bridge and any other contemplated type. Includes formulas for determining cable and suspender lengths, cable tensions, erection calculations, and catenary formulas.

John A. Roebling's Sons Corp.

253—Concrete Roads and Streets

Manual R2 contains material that will help build better concrete roads and streets. The manual discusses design and construction curves, grades, thicknesses, joints, reinforcement, alleys, curbs, crown, drainage, resurfacing, concrete bases, colored concrete, traffic markers, sidewalks. Tables, photographs.

Portland Cement Association.

HIGHWAY, BRIDGES & STREET MATERIALS *continued*

254—Aluminum Lighting Standards

New street lighting catalog, ALS-5, issued by Pfaff & Kendall. Each type of lighting standard is described and complete specifications are given. Dimensions are shown in tabular form. Diagrams show various P&K modifications. Accessories are listed and illustrated. One section is devoted to suitable types of bases.

Pfaff & Kendall.

255—Steel Rope

This publication contains information required for selection and preparation of specifications for wire, strand, and rope lustrations, descriptions, and engineering systems of all kinds, except major suspension bridges. Both standard and special fittings for use with bridge strand and bridge rope are illustrated.

John A. Roebling's Sons Corp.

256—Highway Products and Services

Bulletin ADUCO-90-90811, a catalog which includes all products of United States Steel used in highway construction from grading to surfacing. Sections include products for construction equipment, drainage, bridges and bridge foundations, paving, safety equipment, and highway accessories. Well illustrated.

U. S. Steel Corp.

257—Pozzolith Bridge Concrete

Bulletin P-11 describes *Pozzolith* used in bridge concrete for better quality control. Contains many case histories with operational photographs and diagrams. Included is description of its use in 200 Ontario highway bridges as well as the Barnhart Island bridge of the St. Lawrence Seaway project.

Master Builders Co.

258—Metal Lighting Standards

Kerrigan's new multi-page, indexed catalog contains engineering data on steel and aluminum lighting standards for streets, highways, and bridges. Catalog contains photographs and diagrams as well as complete specifications. Included is section on tests and charts and one listing modifications and accessories.

Kerrigan Iron Works, Inc.

259—Highway Railings

One of the most complete catalogs on this subject. Contains specifications, design data, details for 47 sizes and types of cast posts, dimensions, properties of rails, and other components. A valuable handbook for the consulting engineer engaged in the design of highway railings. Forty pages.

Michael Flynn Manufacturing Co.

260—Concrete Airport Pavement

Manual R147 discusses the structural design of concrete pavements for airport runways, aprons, taxiways and parking areas. Contains design charts for determining pavement thicknesses for varying sub-grades and plane loads. Includes discussion of jointing and other pavement details.

Portland Cement Association.

261—Highway Lighting Guide

Bulletin B-7253 contains basic recommendations and technical data for lighting applications for expressways or freeways; major arterial streets and rural trunk highways. Includes considerations and lighting requirements expected to exist by 1970. Valuable to consultants working on highway outdoor lighting.

Westinghouse Electric Corp.

262—Traffic and Safety Equipment

This illustrated brochure describes Planet's new line of highway traffic and safety equipment. Included are overhead sign trusses, roadside directional signs, bridge railings, and pedestrian overpasses. Planet's highway products are illustrated and described in text. Also make engineered systems and automation equipment.

Planet Corp.

263—Steel Monotube Lighting Poles

Bulletin 29 presents new designs and data covering steel *Monotube* lighting poles for streets, highways, parking lots, shopping centers, and other locations. Poles are engineered for properly mounting today's modern luminaires. Similar information available in Bulletin LS-30 covering aluminum poles.

Union Metal Manufacturing Co.

264—Metal Grid Bridge Roadways

Irving decking catalog F-300 contains illustrations, descriptions and engineering data on open metal grid bridge roadways, with many of the advantages inherent in this type of bridge roadway, such as light weight, cleanliness, drainage, safety, durability, strength, traction, and economy.

Irving Subway Grating Co., Inc.

265—Sign and Signal Spans

Bulletin BT-1 describes Pfaff & Kendall's sign and signal spans for highway, railroad, and allied applications. Built up to 110 feet in length and engineered to withstand winds up to 100 miles per hour. Specifications for box truss sign spans given. Diagrams show construction and indicate dimensions.

Pfaff & Kendall.

INDUSTRIAL PROCESSING EQUIPMENT

266—Process Heating Equipment

Bulletin 548-D features the *Quik-Temp* heating system for steam processing equipment, with a 4 point attack on heat processing losses through: faster production, more productive time, low maintenance cost, and fuel savings. Includes case histories and line diagram of operation for plants with similar heating units.
Fred H. Schaub Engineering Co.

267—Self-Centering Rolls

Bulletin ADUCO-78-78230 contains comprehensive material on the application and use of *Lorig-Aligner* self-centering rolls. This article by E. T. Lorig, chief development engineer for USS, includes operational diagrams and a description of rolls for centering and aligning metal strip on processing lines.
U. S. Steel Corp.

268—Knittel Crusher

Bulletin 858 describes Knittel crusher with ring type double rotor. The literature features comprehensive technical and engineering data, specifications, diagrams, and illustrations. The unit offers an exclusive crushing action that increases capacity, crushes wet sticky material without danger of plugging.
Stephens-Adamson Mfg. Co.

269—Annunciator Systems

Catalog 659 presents the standard Scam line of annunciator equipment. Included is helpful engineering data, diagrams, and dimension drawings. In many cases the consulting engineer will be able to specify annunciator-alarm systems directly from this catalog. Sections on annunciator function and sequences.
Scam Instrument Corp.

270—Titanium Welding Techniques

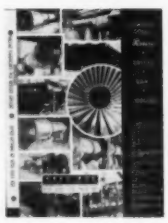
Booklet 3 gives detailed information on fabrication and welding techniques for Titanium and Titanium alloy sheet. Forming is completely discussed and illustrated. Includes table of temperature ranges for forming. Also contains chart of properties of Titanium, bend factors, and formulas for forming.
Republic Steel Corp.

271—Industrial Filters

Catalog IND-1-60 describes a complete line of filtration products to meet all operating requirements of industrial processing. Types of filter media are described and information includes applications, range of filtration, and temperature limits. Typical assemblies are pictured with complete specifications.
Purolator Products Inc.

272—Electronic-Pneumatic Systems

Circular 372 describes system which combines electronic measurement of temperature with pneumatic operation of the controlled device. Consisting of electronic sensors and an amplifier transducer unit which converts the electronic temperature signal to a pneumatic output. Duct, room, outdoor applications.
Powers Regulator Co.



273—Rotary Dryers, Kilns, Coolers

Bulletin AH-438 briefly describes 6 major types of Ruggles-Coles rotary dryers: double and single shell, direct and indirect heat types, steam tube type, hot air type, counterflow and parallel-flow types. Also briefly describes Ruggles-Coles kilns and coolers. Lists typical materials processed in this equipment.
Hardinge Co., Inc.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

274—Chemical Processing Equipment

Bulletin MG-104 describes *Glascote* 778, the most corrosion resistant glass ever applied to chemical processing equipment. The new glass offers 75° higher operating temperature, and is more corrosion and thermal shock resistant than chemical lab glass. Includes glass-lined reactors and heat exchanger tubes.
Glascote Products, Inc.

275—Pressure Controllers

Bulletin D-4150A describes Fisher Wizard II pressure controllers, designed particularly for the process industries. It presents comprehensive information on construction features, operation, calibrated set point adjustment, reversed action, performance, and conversion to other modes of control.
Fisher Governor Co.

276—Industrial Radiant Heaters

Bulletin PE-70 gives product data on both *Vycor* brand tubular heaters and *Pyrex* brand panel heaters. These are two types of industrial heaters for drying, baking, heating, and curing. Bulletin contains pictures of typical installations, exploded view of heaters, and installation illustrations. Specifications given.
Corning Glass Works.

INDUSTRIAL PROCESSING EQUIPMENT *continued*

277—Corrosion Resistant Valves

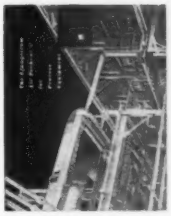
Catalog 1159 describes Chemtrol's complete line of corrosion resistant plastic valves manufactured in polyvinyl chloride Type I and II, acrylonitrile-butadiene-styrene (Kralastic), polypropylene, and Penton. Ball, check, 3-way, needle, globe, ball-cock and foot valves are available for immediate shipment.

Chemtrol

278—Aluminum in Process Industries

Booklet AD460, 80 pages, includes three sections covering process industries applications of Alcoa aluminum, the performance of aluminum with chemicals, and the design of process equipment. Research and development, alloys, advantages of aluminum, and technical reference tables are included.

Aluminum Company of America



279—Process Equipment Preheater

Brochure entitled "The Ljungstrom Air Pre-Heater for Process Equipment" describes the fuel economy possible with this regenerator. Table of comparative fuel and power costs and graph clearly show these economies. Explains how added furnace capacity gives increased production and higher quality.

Air Preheater Corp.

280—Reduction Mills

Bulletin AH-474 covers the major types of reduction mills for both wet and dry grinding and pulverizing. Describes Hardinge Tricone, Rod, Cylindrical, Tube, Batch, Conical, and Disc Roll Mills. Materials which have been dry or wet ground in these mills are listed, and grinding mill accessories described.

Hardinge Co., Inc.

INSTRUMENTS and CONTROLS

281—Process Control Instruments

Catalog 515 describes pneumatic instruments for the process industries manufactured by U. S. Gauge Division of American Machine and Metals, Inc. Indicating controllers for automatic control of pressure and temperature. Illustrations show how recorders operate, measuring elements, and bulbs and connections.

U. S. Gauge Division.

282—Portable Holiday Detectors

Bulletin EP describes Tinker and Rasor's portable damp-climate, pulse-type, holiday detector for surfaces coated or wrapped with high electrical resistance material. Adoptable for use on both large and small diameter pipe as well as flat surfaces. Bulletin furnishes specifications, voltage range, components.

Tinker and Rasor.

283—Liquid Level Indicators

How the Eye-Hye gage helps protect the power plant from liquid level accidents is explained in four-page catalog 500, Sec. CO. A diagram shows the flexibility of placement possible: near boiler, tank, or other vessel, or on instrument panelboard, nearby or considerably removed from the boiler.

Reliance Gauge Column Co.

284—Compact Solenoid Valves

Bulletin covers compact solenoid valves, Marsh *Master-mite*, in ⅛" and ¼" sizes and ten orifice sizes, 3/64" through ¼", pressures up to 540 psi. Used on air, water, petroleum products, coolant, oxygen, hydrogen, and acetylene. Underwriter's approved for use on oxygen and hydrogen and as safety valves.

Marsh Instrument Co.

285—Specifying Guide for Tank Gages

Form 632 is a specification guide especially designed in handy folder form to assist consulting engineers to specify their choice of tank contents gaging systems for each project. Contains sample specifications for hydraulic system, and hydrostatic systems (manually operated and continuous reading).

Liquidometer Corp.

286—Controls for Recorders

Bulletin 18 illustrates and describes the new *Manometer-Servo* (Bubble Gage), an accessory to water level recorders that eliminates the need for stilling wells. Also, described is the Stevens Surface Detector, accessory equipment for stream gaging and hydraulic laboratory equipment. Completely illustrated.

Leupold & Stevens Instruments, Inc.

INSTRUMENTS & CONTROLS *continued*

287—Manometers for Plant and Lab

Catalog 2008 covers U-type, single- and multi-tube well-type, and inclined-tube *Manometers*, for measuring pressure vacuum, flow; draft gauges; indicating liquids; accessories. Explains operating principle and inherent accuracy. Discusses points to consider in selecting *Manometers* for specific applications.
King Engineering Corp.

288—Pneumatic Control Systems

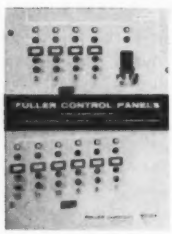
Bulletin M-101 explains the principles of pneumatic controls for heating, cooling, ventilating, air conditioning, and industrial processes. Controllers and controlled devices are shown in detail. Bulletin also covers typical applications ranging from simple thermostat-valve arrangements to complex dual-duct control systems.
Johnson Service Co.

289—Manometer Check Valve

Bulletin 1104 describes the Petrometer Model 1636 *Manometer* check valve which prevents loss of indicating fluid when over-range pressures are encountered. It insures positive action either during sudden surges or gradual increases in pressure. Patented *O-Ring* diaphragm eliminates valve sticking.
Petrometer Corp.

290—Sliding Gate Pressure Regulators

Bulletin J160-1 describes the full line of sliding gate pressure regulators. Available in self-operated, pilot-operated, solenoid-operated, and back pressure models. Sizes ¼" through 6", patented sliding gate seats give tight shut-off, end wire drawing, and cut maintenance. Catalog gives features and engineering data.
OPW-Jordan Corp.



291—Control Panels

Bulletin G-9 describes modern graphic panels for automatic handling of dry materials and process equipment control. Panels are designed and fabricated by manufacturer and are internally wired. Wiring diagram is furnished and supervision is normally furnished for start-up of system. Illustrated.
Fuller Co.

292—Air Filter Gages

Bulletin C-1 presents the standard Dwyer line of filter gages. The Consulting Engineer's specification data is included for each of the three standard types of gages. These gages provide a continuous check on the efficiency of all types of filters. Various types are illustrated. Sales representatives are listed.
F. W. Dwyer Mfg. Co.

293—Electrical Controls

Engineering reference catalog 18A contains a complete line of standard Zenith electric controls and timing devices. Photos, diagrams, engineering data, and prices on automatic transfer switches, magnetic contactors, remote control switches, program clocks, automatic reset timers, cycle timers, and special controls.
Zenith Electric Co.

294—Recording Instruments

Catalog section 43-450 describes weather-proof recording instruments for load and voltage survey. Includes type 45 recorder application data, design features, specifications, circuit diagrams, engineering features, prices, and ordering information. Suitable for switchboard, portable, or pole-mounting.
Westinghouse Electric Corp.

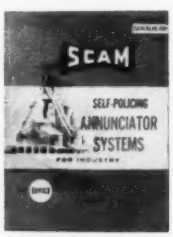
To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

295—Check-Weighing Systems

Bulletin 50 covers high-accuracy systems (±0.25% scale range) for verifying package weight of single- or multi-unit, dry or liquid containers. Operation may be manual or automatic. Includes information on indicating, recording, and totalizing instrumentation for production, inventory, and accounting purposes.
Weighing & Controls, Inc.

296—Temperature, Pressure Controls

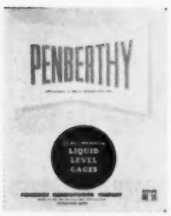
Catalog for engineers who specify temperature, pressure, and control instruments. Detailed specifications on industry's most complete line of thermometers, gauges, controllers, control valves, pressure regulators, air filters, air guns, steam traps, and others. Data is complete and accompanied by illustrations.
H. O. Trerice Co.



297—Annunciator Systems

Catalog 659 presents the standard Scam line of annunciator equipment. Included is helpful engineering data, diagrams, and dimension drawings. In many cases the consulting engineer will be able to specify annunciator-alarm systems directly from this catalog. Sections on annunciator function and sequences.
Scam Instrument Corp.

INSTRUMENTS & CONTROLS *continued*



298—Liquid Level Gages

Catalog 36 describes Penberthy's complete line of liquid level gages, available for all requirements. Plastic-bound and tab indexed for easy reference, this catalog details flat glass reflex gages, gage valves, heating and cooling gages and valves, and accessories. Includes complete technical data and service parts.

Pemberthy Manufacturing Co.

299—Automatic Controls

Catalog 860 lists mercury switch equipped controls for pressure, temperature liquid level, and mechanical movement. Also offered are transformer-relays and mercury switches. Each control is illustrated with accompanying description, specifications, and engineering data. Drawings show control dimensions.

Mercoid Corp.

300—Boiler Water Level Controls

Catalog Section 3 covers single and multi-stage Magnetrols for pressures from 30 to 1668 lbs. WSP. Includes engineering data, many cut-away views, installation sketches, and dimensions. Fully describes and illustrates safety features, infinite-life magnetic principle, flexible switching action, model range.

Magnetrol, Inc.

301—Automatic Metering System

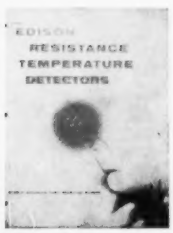
Bulletin FL-56 describes Hetherington & Berner's *Fluidometer*, an automatic batch metering system. Adoptable to practically any liquid measuring problem. Equally accurate with high or low viscosities, eliminating waste. Shown in photo and diagram are direct control, remote control, dual valve, and multi-valve systems.

Hetherington & Berner Inc.

302—Water Control Equipment

Bulletin 315 illustrates and provides specifications for, the complete line of Sparling propeller-type main-line meters, recording instruments, and control equipment. Various applications, flow ranges, sizes, cut-away drawings, and installation information are all included. Pictured are production and test equipment.

Hersey-Sparling Meter Co.



303—Resistance Temperature Detector

Bulletin 3047 describes the Edison resistance temperature detectors – stable, accurate, fast, sensitive, and rugged. Comparisons are made between the old type detectors and the new. Reliable temperature measurement is vital to modern industry. Operating principle, history, and advantages are included.

Thomas A. Edison Industries.

304—Bi-Color Boiler Gauges

Bulletin 2044-A describes *"Multi-Port"* bi-color gauge MP 1050 for boilers operating at pressures up to 1050 psig. Water always shows green and steam red. Vision slot divided into series of round ports. This permits use of small glasses and small mica which are stronger and less sensitive to thermal stress.

Diamond Power Specialty Corp.

305—Portable Hydronion Meters

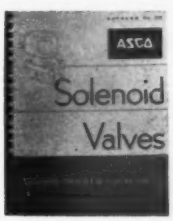
New bulletin describes portable *Hydronion* meters manufactured by Carma Manufacturing Co. Designed to conveniently measure specific conductance of a solution in locations where electric power is not available. Gives ranges, increments, reading selector, and pertinent applications. Illustrated.

Carma Manufacturing Co.

306—Control Guide for Engineers

Barber-Colman Company of Rockford, Illinois, has published an Automatic Control Systems Guide, F-8944, for consulting engineers. The guide discusses *Electronic* control systems and a selection guide for designing various types of automatic systems for air conditioning, heating, and ventilating.

Barber-Colman Co.



307—Solenoid Valves

This solenoid valve catalog provides complete information on the comprehensive line of ASCO solenoid valves. Listed are 2-, 3-, and 4-way valves for standard duty or for special applications (corrosion resistant, sanitary, bulk loading, and steam). An illustrated engineering section includes flow diagrams.

Automatic Switch Co.

308—Steam and Water Service Manual

Engineers designing steam and water service systems can use this manual as a reference guide. Piping diagrams and control equipment descriptions are given for self operating and pneumatic control of fuel oil and storage heaters; domestic process and two-temperature hot water; and heat exchangers.

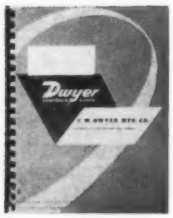
Powers Regulator Co.

309—Pressure Measuring Elements

Catalog 900 illustrates characteristics of standard USG measuring elements. Diaphragm and Bourdon tube elements are pictured. Materials and performance characteristics listed for both conventional capsule and nested capsule types. Tables list dimensions, specifications and materials of Bourdon tubes.

U. S. Gauge Division.

INSTRUMENTS & CONTROLS *continued*



310—Controls and Gages

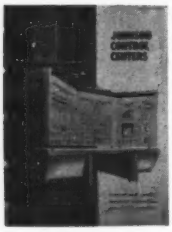
The complete Gage and Control Catalog contains illustrations, prices and complete details on Dwyer *Magnehelic*, gages, manometers, air meters, air filter gages, pitot tubes, pressure actuated switches, flowmeters, combustion testing instruments. Diagrams, conversion curves, and other technical data.

F. W. Dwyer Mfg. Co.

311—Material Level Indicators

Bulletin 1-5-C describes level indicators for dry, pulverized materials—model SG-4 for general purpose and SG-4X for use in hazardous dust locations. Vertical or horizontal mounting. Will control feeders, valves, elevators, and conveyors by starting or stopping the drive motor when predetermined level is reached.

Fuller Co.



312—Pneumatic Control Centers

Bulletin S-103 describes the functions, applications, and operation of centralized pneumatic controls for air conditioning, heating, and ventilating systems. The advantages of using pneumatic transmission are explained and the latest developments in control center instrumentation are shown in this 12-page booklet.

Johnson Service Co.

313—Industrial Liquid Level Gages

King-Gage Catalog 1010 gives details and specifications of hydrostatic gauges for measuring depth, volume, or weight of almost any liquid in any tank or processing vessel, under pressure or vacuum, from any desired location. Describes operation; shows applications in many industries; gives installation data.

King Engineering Corp.

314—Remote Registering Systems

The Stevens *Telemark* System for remote registration of moving elements is described in Bulletin 22. Moving elements such as, liquid levels in streams, reservoirs, positions of gates or precipitation in a precipitation gage are coded into electrical pulses for transmission. Illustrated in line and photograph.

Leupold & Stevens Instruments, Inc.

315—Tank Contents Gaging Systems

Suggested specifications for tank contents gaging systems – hydraulic, hydrostatic, and direct reading — are given in bulletin 463A. Model selection guides and pictorial diagrams are included, along with a list of liquids successfully gaged by Liquidometer systems, and principles of operation of each gage.

Liquidometer Corp.

316—Pressure Gauges, Needle Valves

Catalog 76-G, revised, covers all types pressure, vacuum, and compound gauges. Covers *Master-test* series of extremely accurate test gauges, *Master-gauge* series, *Quality* series, and *Standard* series, gauges covering all requirements. Also includes needle (throttling) valves. Ranges, types, and dimensions.

Marsh Instrument Co.

317—Control Valve Sizing Chart

Bulletin JSC-1 contains charts and other information necessary for proper sliding gate control valve sizing. Shows how to avoid the pitfalls usually associated with regulator sizing. Useful formulae and numerous examples are included. Also shows how to adjust for superheated steam, wet steam, viscous liquids, gases.

OPW-Jordan Corp.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

318—Instrument Line Blowout Gun

Bulletin 1004 describes the Model 1503 Blowout Gun for cleaning out instrument transmission lines and other lines where no automatic means is available for blowing out. Intended for use on lines vented beyond the restricted point to the atmosphere. Exploded view shows components. Laboratory tests shown.

Petrometer Corp.

319—Water Columns and Equipment

Sec. AO of catalog 500 describes water columns with float-operated alarms for pressures from 0 to 250 psi. Cutaway views show construction and operation. Advantages with reference to additional detailed literature. Various operations at Reliance plant are pictured. Installations are shown.

Reliance Gauge Column Co.

320—Portable Detectors

Bulletin M1 describes Tinker and Rasor's portable detector for locating bare spots in thin protective films. Widely accepted in the corrosion control and industrial painting industry. It is nondestructive, applied voltage never exceeds 67½ volts. Bulletin furnishes specifications, operating data, and prices.

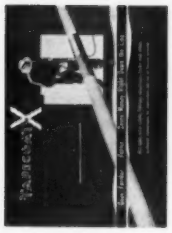
Tinker and Rasor.

INSULATION & PROTECTIVE COATINGS

321—Asbestos Insulation

Engineering manual F76-321 gives detailed information on Union Asbestos & Rubber Company's *Unibestos* pipe insulation. Precision production methods and rigid quality control described and pictured. Important advantages, installation photographs, comparison charts, application methods, and technical data.

Union Asbestos & Rubber Co.



322—Protective Coating Tape

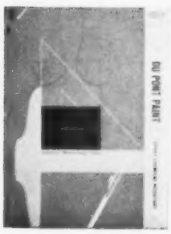
Tapecoat X is a coal tar protective coating in tape form for pipe, pipe fittings and joints, conduit, cable, insulated pipe, tie rods. Material is heated lightly with a torch, then wrapped onto pipe surface with one-half inch overlap. Provides protection on underground pipe equivalent to hot-applied coal tar.

Tapecoat Co.

323—Long Textile Insulation

Revised catalog ULD describes the use of *Ultralite*, the long textile type insulation for duct wrap and duct liner. Characteristics of *Ultralite* duct liner, together with application methods, are listed. Facings available, including new gray fire resistant coating, shipping information, and specifications are given.

Gustin-Bacon Manufacturing Co.



324—Masonry Block Primer

Bulletin A-7436 describes Du Pont's masonry block primer designed to give a smooth surface on porous masonry in a single coat. Information on application, thinning, coverage, drying time, topcoats, and colors. Picture compares block with three coats of conventional cement paint and one coat of masonry block primer.

E. I. Du Pont De Nemours & Co., Inc.

325—Ozone-Resisting Insulation

Bulletin RCD 702 is a descriptive-type folder covering two of Rome Cable's ozone-resisting insulations — oil-base (Rozone) and butyl-base (Rozone A). Descriptions of these insulations are included along with information and specs on Rome's flame-retardant polyethylene sheathing material, thermoplastic Roseal.

Rome Cable Division of Alcoa.

326—Butyl Rubber

Twelve-page, two-color bulletin describes in detail Butyl rubber. Many applications of this rubber that stays "alive" are pictured. Many comparison graphs show effect of heat aging, electrical stability, shock absorption, sound damping, tear resistance, abrasion loss, gas permeability, and low temperature flexibility.

Enjay Co., Inc.

327—Foamsil Insulating Material

Bulletin FS-1 describes Foamsil, a new insulating and refractory material. Contains background information on this new material, which is 99% pure fused silica and has a practical operating range of -450° F to +2200 F. Material is unaffected by practically all commonly used acids. Physical characteristics outlined.

Pittsburgh Corning Corp.

328—Corrosion Prevention Tape

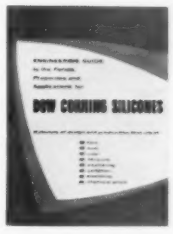
File DF:T, 1015-B describes Johns-Manville *Dutch Brand* polyvinyl pipe wrapping tape for the prevention of corrosion above and below ground. This unique product is pressure-sensitive and can be quickly and easily applied on the job. Data file features a complete coverage table and application procedures.

Johns-Manville Dutch Brand Division.

329—Surface Coatings and Sealers

Bulletins C and CRC describe Foster's decorative protective coatings used to protect insulation from weather, physical abuse, and other damaging factors. The latter bulletin is a Coatings Reference Chart including such data as coverage, drying time, service temperature limits, and other pertinent information.

Benjamin Foster Co.



330—Silicone Products

The forms, properties and applications of Dow Corning silicone products are reviewed in this 16-page brochure, 1-115. Of vital interest to consulting engineers and production-maintenance men are the silicone materials that resist the effects of time, heat, moisture, weathering, oxidation, and chemicals.

Dow Corning Corp.

331—Permalex Insulation

Colorful brochure GEA-7047 describes the advantages of General Electric's *Permalex* insulation. You get 12 percent larger transformer with the same operating life and same investment. Advantages of using this insulation in pole-type distribution, large distribution, and network transformers is outlined.

General Electric Co.

332—Glass Fiber Insulation

Bulletin ULHT 360 describes *Ultralite*, Gustin-Bacon's rugged glass fiber insulation. Gives comparison of Btu losses, uninsulated versus insulated tanks. Includes features, examples, graphs, and application photographs. Complete details, line drawings, and photographs on two methods of insulating tanks.

Gustin-Bacon Mfg. Co.

INSULATION & PROTECTIVE COATINGS *continued*

333—Silicone Insulation

Bulletin 4-218 explains how Dow Corning 5 Compound protects insulators and electrical equipment bushings against excessive leakage, flash-overs, and service interruptions resulting from contaminated atmospheres or wet conditions. Photographs show how 5 Compound prevents formation of conductive paths.
Dow Corning Corp.

334—Coal-Tar Protective Tape

Hot coal tar protection in easy-to-apply tape form for pipe, pipe fittings and joints, conduit, cable, insulated pipe, tie rods. Material is heated lightly to soften the pitch, then spirally wrapped onto pipe surface. Tapecoat provides long-life protection equivalent to a hot-applied coal-tar pipeline coating.
Tapecoat Co.

335—Polyurethane Insulation

Data sheet describes the new low temperature insulation for the temperature range of minus 300° to plus 225°F. A 85% closed cell product weighing approximately 2.3 lbs per cu ft with ak factor of .15 at 70° ambient. Lightweight, rugged, easy to apply. Can be vapor-proofed with standard materials.
Union Asbestos & Rubber Co.

336—Chemical Resistant Enamel

Bulletin A-7441 describes Du Pont's *Epoxy* chemical resistant enamel. Contains information on use, composition application, mixing, thinning, drying, surface preparation, finishing systems, and colors available. Also lists features, interested industries, types of surfaces usually involved, and availability.
E. I. Du Pont De Nemours & Co., Inc.

337—Stay-Dry Insulation

Bulletin FI-107 introduces *Stay-Dry* insulation for commercial applications from +35°F to +350°F. Contains illustrations of features, application specifications, suggested *Stay-Dry* thicknesses, available sizes and thicknesses for iron pipe and copper tubing, and a list of *Foamglas'* physical properties.
Pittsburgh Corning Corp.

338—Duct-Sealing Tape

Bulletin 74-80 describes the new Johns-Manville *Dutch Brand* silver cloth duct-sealing tape. This tape has a vinyl-coated silver cloth backing and a quick-stick, tight-holding sensitive adhesive. Suited for forming, holding, and sealing air duct insulation in heating, ventilating, and air-conditioning.
Johns-Manville Dutch Brand Division.

339—Snap-On Pipe Insulation

"G-B Snap-On Pipe Insulation," eight-page booklet, describes characteristics and application data for one piece, fine-glass pipe insulation. Application specifications cover plumbing, heating, insulation of valves and fittings, cold piping, dual temperature, and outdoor piping. Thickness charts are also included.
Gustin-Bacon Manufacturing Co.

340—Coatings and Weather Protection

Bulletins M and MRC describe Foster's mastic coatings applied for weather protection of water absorptive materials for thermal insulation. The latter bulletin is a mastics reference chart including such data as description, coverage, drying time, service temperature, flash point, clean-up solvent, and other data.
Benjamin Foster Co.

LIGHTING FIXTURES & ACCESSORIES

341—Fluorescent Luminaires

Bulletin 61-150-7 gives a full description of the *Mainliner* fluorescent luminaire. This line offers seven different modular sizes with shieldings of different diffusers, lens, and louvers. Bulletin is illustrated with photographs and dimensional drawings. Detailed installation and application information.
Westinghouse Electric Corp.

342—Lighting Systems

The third of a series of bulletins on Sylvania's lighting systems which include *Sylvan-Aire* (continuous corrugated plastic), *Sylva-Lume* (modular plastic panels) and *Sylva-Cell* (louvered panels in either metal or plastic). Includes engineer's specifications and schematic drawing showing construction.
Sylvania Electric Products Inc.

LIGHTING FIXTURES & ACCESSORIES *continued*

343—Hinged and Framed Troffers

Specification Sheet 30 describes the hinged and framed troffer manufactured by the Wakefield Company. Photograph illustrates actual troffer and line drawing gives specific dimensions. ETL photometric report included. Line drawings show units to fit various ceiling constructions. Gives specifying points.

Wakefield Co.

344—Lighting Specifications Book

RLM standard specifications book (1960) for industrial lighting units includes three new specifications for 1500 ma-units; D-4 fluorescent semi-direct medium high mounting, SD-3AL semi-direct aluminum, and SD-3PE semi-direct porcelain enamel units. Also many upward revisions of other existing specifications.

RLM Standards Institute.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

345—Compact Exit Signs

Folio 60-2 introduces the newest, most compact, code regulated illuminated directionals. "50 line" EXITS by mcPhilben are all cast aluminum, glass or stencil face, incandescent or fluorescent. Wall, ceiling extending bracket, recessed or pendant series available. Contains specifications and engineering data.

mcPhilben Lighting Inc.

346—Shallow Fluorescent Fixtures

Catalog 32, "Surface and Pendant Corona", describes new shallow fluorescent unit which combines walnut and birch frame with expansive luminous styrene panel. Many sizes, distinctive appearance. For use wherever handsome lighting is called for—offices, residences, board rooms, reception areas.

Lightolier Incorporated.

347—Fluorescent After-Glow Exits

Folder EX-61 describes Perfeclite's entire line of fluorescent exit units. Features include projected letters, after glow, illuminated bottom panels, 6" letters, choice of face colors. Offered in lucite or stencil face with or without arrows. Includes specifications and photographs of all models.

Perfeclite Co.

348—Commercial Lighting Fixtures

Catalog 61-320 introduces a new series of commercial lighting fixtures for service station, sports field, shopping center, parking lots, underwater, mine, general purpose or heavy duty needs. The bulletin includes fixture photographs, special features, descriptive data, price lists, and accessories available.

Westinghouse Electric Corp.

349—Fluorescent Lighting Fixtures

Bulletin 14 illustrates the new *Gateway* fluorescent fixture with concave *Gratelite* or *Prismoid* louvers. Units feature tubular designed side wings. Continuous one-piece 8′ or 4′ side wings. Bottoms hinge from steel end plate for strength. Complete. *Gateway* photometric data and engineering information included.

Edwin F. Guth Co.

350—Illuminated Ceilings

Bulletin D describes the new *Sky-Glo* illuminated ceilings by the Benjamin Division of Thomas Industries Inc. The new system is designed for greater efficiency, versatility, and economy. Various types of diffusers are shown along with line drawings detailing construction. Features and illumination data.

Thomas Industries Inc., Benjamin Div.

351—Fluorescent Lamp Ballast Guide

Bulletin ATC-110 is a new fluorescent lamp ballast buyer's guide, listing the newest models. Included is electrical data, physical dimensions, and packaging of popular 60 cycle ballasts. All information is in tabular form for easy reference. Also includes conditions of sale and other pertinent information.

Advance Transformer Co.

352—*Plexiglas* Diffusers and Lenses

Bulletin PL-399 covers use of *Plexiglas* acrylic plastic for diffusers and lenses in lighting equipment. Lists grades, properties, colors, sizes. Includes light-transmittance and UV-transmittance graphs, spectrophotometric curves, design and installation details, distribution curves and coefficients of utiliziation data.

Rohm & Haas Co.

353—Fluorescent Lamp Ballast

Bulletin B-1000, superseding B570-10, gives data and prices of Jefferson's fluorescent lamp ballasts. Included are wiring diagrams and complete specifications on rapid start ballasts of 60 cycle, normal power, and high power. Sound control chart helps you make the proper selection of lamp ballast.

Jefferson Electric Co.

LIGHTING FIXTURES & ACCESSORIES *continued*

354—Fluorescent Lighting Ballasts

This bi-monthly newsletter covers advances in ballasts for fluorescent lighting and the activities of the Certified Ballast Manufacturers Association. It reports the latest news of industry's progress in improving fluorescent lighting performance standards. Sent free to consulting engineers on request.

Ceritfied Ballast Manufacturers Assn.

355—"Quartzlite 500" Lamps

Bulletin QL-560 describes in full Appleton's all new "Quartzlite 500". The brochure gives information on application, features, photometric data, and accessories. This is the first successful lighting unit ever developed for use with the Quartzline lamp. Gives user exceptional control and high efficiency.

Appleton Electric Co.

356—Fluorescent Ballast Distributors

A revised list of electrical wholesalers who stock Advance fluorescent lamp ballasts is available in Bulletin 1201, Revised. Wholesalers listed stock popular Advance ballasts and will replace inoperative in-warranty Advance ballasts free of charge. The warranty policy of the company is explained.

Advance Transformer Co.

357—Industrial Fluorescent Lighting

Bulletin F describes the newly designed and expanded line of industrial fluorescent lighting fixtures offered by the Benjamin Division of Thomas Industries Inc. Catalog includes detailed illustrations and complete specifications covering all elements of the line. The many features of this new line are explained.

Thomas Industries Inc., Benjamin Div.

358—Louver Diffusers

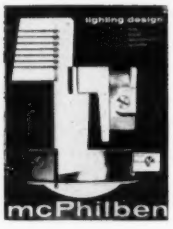
Folder 6 describes the *Mystic Gratelite* louver diffuser. When installed in fixtures or overall ceilings, *Mystic Gratelite* changes from an open louver diffuser to a solid-appearing luminous panel—depending on your point of view. Folder shows complete line of Guth fluorescent fixtures and *Gratelite* overall ceilings.

Edwin F. Guth Co.

359—Recessed Incandescent Fixtures

Colorful new brochure 31 describing Lightolier's line of recessed incandescent downlighting, just released. Construction features are detailed with special emphasis on the exclusive *Duo-Style* trim flange, the new *Multi-Groove* baffle, the *Prismatex* low brightness lens. Complete technical data and ordering information.

Lightolier Incorporated.



360—Cast Aluminum Lighting Units

Folio 60-1, a 12 page booklet, describes mcPhilben's unique line of cast aluminum special purpose lighting units. Applications for vaportight, exterior, general interior use and directional signs. Includes specifications, drawings, and optional features to assist you in selection of quality lighting.

mcPhilben Lighting, Inc.

361—*Crodrum* Ceiling Lights

Folder 61-B describes new line of high intensity, prismatic, ceiling drum lighting fixtures for use where high foot candle levels are required. *Crodrums* are available in 150, 200 and 300 watt units. Folder furnishes full product specifications including light distribution and advanced design features.

Perfeclite Co.

362—Suspension Fluorescent Fixtures

Descriptive folder V-820 features Sylvania's newest suspension fluorescent lighting fixture. Together with appropriate catalog pages, information is provided which emphasizes the graceful styling which is the keynote of this line. Fixtures are illustrated as are the plastic panel and plastic louver shielding.

Sylvania Electric Products Inc.

363—RLM Label and Program

An answer guide to RLM labeled industrial lighting equipment has just been published for use of buyers and specifiers by the RLM Standards Institute. Pamphlet answers the most popularly asked questions concerning the RLM label and the RLM program. Reviews factors related to selection of lighting equipment.

RLM Standards Institute.

364—Pre-Assembled Ceiling Fixtures

Specification Sheet 14 describes the Wakefield Twenty, a quickly installed, pre-assembled, luminous ceiling unit. Dimensional drawing and photograph of the unit shown along with line illustrations of various types of diffusers. Drawings for installation purposes and specifications are included.

Wakefield Co.

365—Surface Mounted Fixtures

Bulletin 61-150-6 presents a series of surface mounted units for ceilings in markets, stores, and corridors. The new stripliner luminaire is a highly efficient economy type unit where semi-direct, slim, smooth light is desired. Engineering data, dimension drawing, application, and ordering information.

Westinghouse Electric Corp.

MATERIALS HANDLING & STORAGE FACILITIES

366—Constant-Feed Weigh Systems

Bulletin 40 covers systems for continuously maintaining uniform flow rates of solids or liquids used in processing and formulating bulk materials. Details the use of unitized components to reduce development costs of job-engineered systems. Includes section on control instrumentation. Includes photographs.
Weighing & Controls, Inc.

367—Automatic Packaging Machines

Bulletin explains operation of world's most versatile automatic packaging machine Lynch *Robo-Wrap*. Tells why unique hand-over-hand action gives maximum production at lower drive speeds, less stress on materials, less machine wear. Forms, fills, seals; packages liquids, solids, powders, granules.
Lynch Corp.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

368—Vacuum Handling Systems

Six-page, two-color bulletin V-100 describes Whiting *Pressuregrip* vacuum handling systems, newest contribution to efficient materials handling. Closed vacuum system quickly and safely handles a great variety of products, cuts costs. Gives specifications and suggests a few of the many possible applications.
Whiting Corp.

369—Mobile 60-Ton Truck Crane

Catalog 770-TG-2 describes American 700 Series 60-ton truck crane for handling heavy material. Actual illustrations shown on large engineering projects and big lifts. The catalog also describes many exclusive features claimed by the company on the 60-ton capacity truck crane to benefit owners and users.
American Hoist & Derrick Co.

370—Pneumatic Vibrators

Catalog 109 describes the complete line of Cleveland air and electrically operated vibrators. Available in a full range of types and sizes capable of shaking anything. Completely illustrated with pictures of each type of vibrator, cutaways, and vibrators in use. Complete specifications with engineering data sheet.
Cleveland Vibrator Co.

371—Conveyors and Elevators

Bulletin 358 describes Redler *En Masse* conveyor and elevators. Features comprehensive technical and engineering data, specifications, diagrams, and application photographs. Redler conveyor elevators can be applied horizontally, around bends, on inclines, and vertically to convey pulverized, granular, small lump, and flaked.
Stephens-Adamson Mfg. Co.

372—Monorail Cars

Page reprinted from the St. Louis Post-Dispatch tells story of how monorail cars distribute merchandise in a St. Louis store. Shows how the CM *Telematic* electronically controls the flow of merchandise. Important destination points are pictured with explanatory captions. Layout of the system included.
Columbus McKinnon Chain Corp.

373—Automatic Bulk Handling

Bulletin 531, "New Techniques for Automatic Bulk Handling," is a 12-page report covering latest methods of pneumatic conveying. It details techniques for centralized automatic control, flow control, and bulk materials distribution throughout production. Installations are pictured.
Dracco Division of Fuller Co.

374—Car Pullers

Ten-page bulletin L-6 shows capstan type car puller for moving cars a short distance using manila rope. Three styles of drum car pullers for heavy duty car moving, shuttle work, or for servicing very large areas are also listed, as well as barge movers for shifting barges back and forth during unloading.
Clyde Iron Works, Inc.

375—Materials Handling Equipment

Sixteen-page, two-color bulletin 246 offers a definitive look at all Whiting materials handling equipment – overhead cranes, *Tranbeam* and *Pressuregrip* handling systems, and *Trackmobiles*. Fully illustrated booklet describes many outstanding design features of each product and shows how each is being used.
Whiting Corp.

376—Moving Sidewalks and Ramps

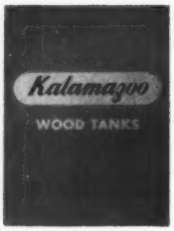
Bulletin 457 describes *Speedwalk* and *Speedramp* passenger conveyor systems from Stephens-Adamson. The literature presents comprehensive technical data, specifications, and illustrations of belt support and balustrade types. Also handrail and balustrade details, dimensions, and installation of moving sidewalks.
Stephens-Adamson Mfg. Co.

MATERIAL HANDLING & STORAGE FACILITIES *continued*

377—Escalators

Brochure 660 describes new line of Haughton escalators. Lists available sizes and corresponding capacities, with arrangement suggestions. Includes typical layout with minimum required dimensions. Pictures typical Haughton escalator applications. Factory branches listed.

Haughton Elevtator Co., Div. of Toledo Scale Corp.



378—Wood Tanks

Eight-page bulletin 655-W explains why wood tanks can meet conditions other types of tanks cannot. It describes round, rectangular, and special tanks, as well as vats, boxes, sinks, and flumes. Lists possible uses for each along with the type of hardware and lining available, and gives installation photographs.

Kalamazoo Tank & Silo Co.

379—Electrical Precipitation

Bulletin 2-ATC-4 describes design and construction of Aerotec's electrical precipitation service. This magnetic rapping system is utilized to supplement gravity action of material falling into a hopper. Delivers light impacts to the electrodes in continuous sequence inducing uniform disposition of materials.

Aerotec Industries, Inc.

380—Curve Crown Pulleys

Bulletin 558 describes *Curve-Crown* welded, all-steel pulleys. The literature features comprehensive technical and engineering data, specifications, diagrams, and illustrations on the S-A *Curve-Crown* welded, all-steel pulley. This revolutionary design offers maximum belt training effect and minimum belt wear.

Stephens-Adamson Mfg. Co.

381—Trackmobiles

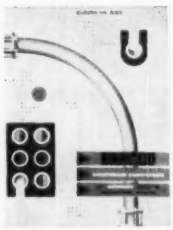
Bulletin 245 describes in four full-color pages the important role played by a Whiting *Trackmobile* and a unique Whiting radial transfer table in the operation of Union Tank Car Company's unusual circular maintenance shop. Full description of the shop shows why it is considered one of the most advanced.

Whiting Corp.

382—Materials Classifying Systems

Bulletin describes two types of classifying systems, both combining high efficiency with low power requirements and moderate cost. Units separate dry fine powdered or fibrous material from coarse within a fine product range of 10 to 400 mesh. Power requirements from 0.04 to 0.5 fan hp per ton of feed per hour.

Buell Engineering Co., Inc.



383—Airstream Conveyors

Bulletin 530 presents more than a dozen illustrated examples of how *Airstream* conveyors are used for efficient dry bulk material handling in a variety of industries. Described is a complete range of conveyor system components, and accessories with specifications. Line drawings show functions and conveyor types.

Dracco Division of Fuller Co.

384—Power and Free Conveyors

Bulletin 159 describes *Power-Flex*, the CM power and free conveyor system. Construction and operating features of rail, chain, and trolleys are explained and pictured. Typical *Power-Flex* installation with *Telematic* dispatch control is diagrammed. Specifications and service to consulting engineers.

Columbus McKinnon Chain Corp.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

385—Industrial Bulk Storage Tanks

Catalog 1839 features installation photos, specifications, and storage characteristics of Butler round, square, coated, and *Bulk-O-Matic* tanks for dry bulk commodities. A wide variety of bulk products being stored in Butler tanks include plastic pellets, sugar, roofing, granules, coal, and others.

Butler Manufacturing Co.

386—Overhead Traveling Cranes

Bulletin 500A covers Conco custom-engineered overhead electric traveling cranes, of double girder construction. Can be furnished in a wide range of capacities and spans. Also included are hand-powered overhead traveling cranes, hand-powered and electric hoists.

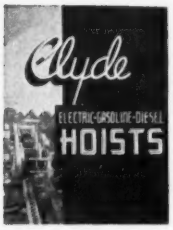
Conco Engineering Works, Division of H. D. Conkey & Co.

387—Automatic Handling Systems

Catalog 67-A describes, illustrates (photographs and diagrams) engineered and automated handling systems. The 16-page "Plan with Planet" brochure also illustrates equipment for bulk and unit materials, automated and special handling machinery, and foundry equipment. Describes Planet's creative service.

Planet Corp.

MATERIAL HANDLING & STORAGE FACILITIES *continued*



388—Power Hoists

Bulletin 34A, 20 pages, describes the Clyde line of electric, gasoline, and diesel hoists. Gives construction details of medium capacity hoists of various line pulls. Also includes information as to selecting the hoist, information required for hoist quotation, and table of drum cable capacities. Available accessories are listed.
Clyde Iron Works, Inc.

389—Tile Tanks and Linings

Bulletin A-160 outlines scope of complete engineering, installation, and maintenance service on tile-faced reinforced concrete tanks, chests, vats, silos, and others. Also includes a wide range of ceramic and membrane linings for resistance against corrosion and abrasion. Various types of tanks are illustrated.
Stebbins Engineering & Mfg. Co.

390—Industrial Storage Systems

Catalog 9129 gives construction details, sizes and capacities of Marietta industrial silos. Line drawings show construction details and photographs show installations. Complete information on Marietta's construction service. Shows the four types of concrete staves offered.
Marietta Concrete Division
American-Marietta Co.

391—Materials Handling

Bulletin 380.010 defines basic rules for handling dry, free-flowing materials. Describes problems of moving material, bin design, and hoppers and spouts. Companion catalog 390.010 tabulates feeder selection for 175 materials. Lists capacities and ranges of entire feeder line. Convenient self-selection data.
Wallace & Tiernan Inc.

392—Elevating Conveyors

Bulletin describes the Lynch Robo-Lift machine that carries materials any vertical or horizontal distance, handling all free-flowing bulk materials gently by vibratory, belt, or gravity feeds. Speeds, simplifies batching operations; controls hopper-fed packaging; moves, stores industrial components; no rehandling.
Lynch Corp.

393—Catenary Belt Conveyors

Bulletin 260 describes new *Flexiroll* catenary belt conveyor carrier from Stephens-Adamson. Offered in 18", 20", 24", 30", and 36" belt widths, provides true catenary suspension for the conveyor belt under all load conditions. Bulletin features engineering specifications, technical data, construction, and application details.
Stephens-Adamson Mfg. Co.

394—Overhead Handling Equipment

Automatic Electric Company's award-winning plant at Northlake, Illinois, utilizes Whiting *Trambeam* at a number of important areas. Four-page, full-color bulletin M-33 describes how this overhead handling equipment increases storage capacity, keeps materials moving at AE's efficient 35-acre installation.
Whiting Corp.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

395—Vitrified Glazed Tile Tanks

Kalamazoo vitrified glazed tile tanks and chests are described in four-page bulletin I-55-T. Drawings and photos show how the two types of tile blocks available provide flexibility of wall design. Types, sizes, design, erection, and cost are discussed, and typical installations in industry are pictured.
Kalamazoo Tank & Silo Co.

396—Revolver Cranes

Catalog 400-R-4 describes American revolver cranes for handling heavy materials. Capacity of 400 tons; adaptable to gantry, fixed, or barge mounting; for use with hook, bucket, magnet, or pile hammer. Contains many illustrations of American revolver cranes at work in varied situations. Typical assemblies shown.
American Hoist & Derrick Co.

397—Elevator Systems

Catalog SW-1 describes the complete line of Haughton Elevators, with special detailed information given on Haughton "*Auto-Signamatic*" systems for complete automation of multiple-unit elevator groups. Includes recommended sizes and dimensions for passenger, freight, hospital elevators, and dumbwaiters.
Haughton Elevator Co.

398—Air-Powered Vibrating Feeders

Bulletin 1000 describes Cleveland's air-powered vibrating feeders designed to move with air and control the flow. Various types of feeders are illustrated. Sheet for outlining your requirements for proper feeder selection is enclosed. Bulletin outlines the many advantages of Cleveland feeders.
Cleveland Vibrating Co.

MECHANICAL POWER TRANSMISSION

399—Gears, Reducers, Fluid Mixers

"Power Thrifty" bulletin describes briefly all the products manufactured by the Philadelphia Gear Corporation. Listed are various types of power transmission, valve controls, fluid mixers, mechanical couplings, and industrial gears. Each product listed is illustrated and described. Cutaways show construction.

Philadelphia Gear Corp.

403—Packaged Drive Units

Bulletin 51 B 8166A describes *Ultra-Speed* packaged drive units manufactured by Allis-Chalmers. This is a complete conversion package with components designed and built to work together. Fully illustrated with features pointed out. Typical schematic diagram and pictures of uses in industry included.

Allis-Chalmers.

400—Gear Type Couplings

Catalog 678-M65 describes the complete line of Fast's self-aligning, gear-type couplings and acquaints you with both standard and special couplings. The Fast principle is explained and cutaways show components and operation. All types of couplings are illustrated with application explanations. Special designs.

Koppers Co., Inc.

404—Flexible Gear Couplings

Advantages and typical applications of flexible gear couplings are pictured and described in 16-page catalog C-5, "The Revolutionary New Sier-Bath Flexible Gear Couplings." Couplings are available in standard, vertical millmotor, floating shaft, spaced type, and in many special purpose types.

Sier-Bath Gear & Pump Co., Inc.

401—Universal Joints

Bulletin CS-10 describes and illustrates the five standard sizes of bevel gear universal joints available. For remote control of valves, pumps, engines, antennae, ventilators, equipment in inaccessible locations. Operate at any angle from 0° to 135° on vertical center line, or from 0° to 360° on horizontal center line.

Condenser Service & Engrg. Co., Inc.

405—Fluid Drives

Bulletin A-719 describes American-Standard's *Gyrol* fluid drive for forced draft fan, centrifugal compressors, and other applications. Principles of fluid drive explained and illustrated with photographs and schematics. Installations, advantages, components, selection charts, dimensions included. Ordering data.

American-Standard Industrial Division.

402—Centrifugal Pump Drives

Catalog 32 shows applications, specifications, and engineering details of right-angle solid shaft gear drives for centrifugal pumps and many industrial uses. Also describes *Redi-Torq* drive for use with auxiliary engine to automatically eliminate service interruptions due to power failure.

Johnson Gear & Mfg. Co., Ltd.

406—Gears and Power Transmission

Bulletin G-127 is a comprehensive catalog of various types of gears and power transmission manufactured by Philadelphia Gear Corporation. Illustrated are types of gears and gear cutting and finishing operations. Complete engineering data to assist in the selection of proper gear. Tables and specifications.

Philadelphia Gear Corp.

MEETINGS, CONVENTIONS & TRAVEL

407—Birmingham, Alabama

Folder describes the facilities of Hotel Thomas Jefferson in Birmingham, Alabama. Rich, but unobtrusive, decor in luxurious suites is perfect for entertaining that special client. Completely air conditioned, TV, radio. Excellent meeting rooms make this hotel Birmingham's convention headquarters. Excellent food.

Hotel Thomas Jefferson.

408—Alabama Convention Spot

Grand Hotel, with its adjacent Lakewood Golf Club, each year is host to numerous corporation board meetings and sales conferences, as well as to many smaller executive and golfing groups. For those desiring complete information we have a special convention kit. Delightful location, excellent cuisine.

Grand Hotel.

MEETINGS, CONVENTIONS & TRAVEL *continued*

409—Chicago, Illinois

Folder describes the Acres Motel located at 5600 North Lincoln Avenue on U. S. Route 41 in Chicago, Illinois. Accommodations for every taste — single rooms, double rooms, kitchenettes, and apartments. Rooms have individual temperature control. Fine restaurant, swimming pool, and TV. Close to shopping center.
The Acres Motel.

410—Washington, D. C.

Hotel Washington offers relaxed living. You can drive right into the hotel, via the motor lobby entrance and private registration desk. Dress as you please, your privacy is assured. Smart cocktail lounge, sky terrace, beautifully decorated modern rooms, superb food. Heart of shopping and theatrical districts.
Hotel Washington.

411—Fort Lauderdale, Florida

Folder describes Ruttger's By The Sea in Fort Lauderdale, Florida. Printed in full color, this folder shows deep sea fishing, swimming pool, relaxing areas, and beach facilities. Typical room, lounge, and dining room also shown. Nearby golfing, horse racing, Jai-Alai, and dog racing for entertainment.
Ruttger's By The Sea.

412—Minneapolis, Minnesota

Colorful booklet describes and pictures the facilities of the Pick-Nicollet hotel in Minneapolis. Ideal facilities for conventions, meetings, and trade shows. Services include PA systems, television, moving picture projection, and other special equipment in this 600 room hotel. Booklet shows modern decor.
Pick-Nicollet.

413—Mobile, Alabama

Folder describes Hotel Admiral Semmes located in Mobile, Alabama, the Azalea City and one of America's most interesting old cities. A warm and friendly atmosphere and accommodations offer the utmost in comfort and pleasure. Completely air conditioned, television and radio, automobile entrance.
Hotel Admiral Semmes.

414—Point Clear, Alabama

Grand Hotel, Point Clear on Mobile Bay, Alabama, offers colorful booklet on the facilities they provide for the vacationer. An eighteen hole golf course has clubhouse with complete facilities for entertaining. Cruising, fishing, dancing, tennis, and swimming for recreation. Exquisite cuisine and flawless service.
Grand Hotel.

415—Galveston, Texas

Folder describes Hotel Galvez and Villa located less than one hour drive from Houston via super highway. Thirty mile beach, swimming pool, fishing, horseback riding, tennis and golf are offered for recreation. Completely air conditioned. Facilities of Moody Center available for conventions up to 3500 persons.
Hotel Galvez.

416—Chicago, Illinois

Folder describes the Acres Motel located on U. S. Route 41 in Chicago, Illinois. A convenient location whether you are headed north, south, or west. A few minutes drive from Chicago's Near North Side and only twenty minutes from the Loop. Swimming pool, TV, fine restaurant, individual temperature controls.
The Acres Motel.

PIPING, VALVES, & PLUMBING SUPPLIES

417—Waste and Drainage Systems

Engineering handbook on properties and performance of Vulcathene Waste and Drainage Systems. Describes complete range and type of Vulcathene fittings, sinks, traps, and pipe. Contains technical and dimensional data, and engineering drawings. Explains patented *Polyfusion* method for joining Vulcathene fittings.
American Vulcathene Division.

418—Valves for Industry

Consultants concerned with valves for industrial application, power plants, and water and sewage works will find handbook 02B2555 a must. Discusses what type of valve to use where, and why. Selection data on a broad line of cone-type valves includes descriptions, performance curves and specifications.
Allis-Chalmers.

PIPING, VALVES & PLUMBING SUPPLIES *continued*

419—Plumbing Drainage Supports

Bulletin 56-1 describes Zurn *Thinline* systems for supporting wall-type fixtures, roof drains, floor drains, interceptors, *Supremo* cleanouts, *Inspecdor*, *Shoktrol*, hydrants, swimming pool equipment, and pipe line strainers. Includes engineering drawings, photographs, dimensions, specifications, and application data.

Zurn Industries, Inc.

420—Steam Traps

Bulletin 808-B describes the new 500-C series steam traps, combination open float and thermostatic type. Cutaway drawings show both thermostat and bucket operation. Photographs show accessibility of parts for service. Gives specifications needed for ordering. Includes capacities and specifications.

Wright-Austin Co.

421—Steel Pipe and Couplings

This new bulletin gives sizes, lengths, threads, weights, and carton contents of merchant, half and API line pipe couplings plus other information including complete specifications on standard, extra strong, double extra strong, and structural pipe. Illustrated and printed in two colors on durable stock.

Wheatland Steel Products Co.

422—Valve Comparison Chart

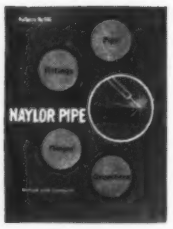
Bulletin 1012 is a OIC valve comparison chart, republished with up-to-date valve cross references. New features: breakdown on valve types by pressure class and design; federal specifications; valve trim cross reference chart; other valve manufacturers products cross referenced to OIC valves. Speeds up specifying.

Ohio Injector Co.

423—Rubber Seat Butterfly Valves

Bulletin 10J is a new catalog describing the new *Monoflange* Mark II rubber seat butterfly valve. The catalog has been designed to be the ideal working tool for engineers and users of this type equipment. Complete specifications, flow data, certified drawings, weights, freight rates, and prices are included.

Henry Pratt Co.



424—Lightweight Pipe and Fittings

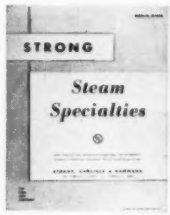
New 8-page condensed catalog summarizes complete line of Naylor lightweight pipe, fittings, flanges, and connections. Lists typical applications. Includes standard specifications on pipe from 4 to 30 inches diameter, together with details on standard fittings and flanges. Covers couplings for pipelines.

Naylor Pipe Co.

425—Eccentric Plug Valve

The newest W-K-M product, the eccentric plug valve is described in Bulletin AE 1059. Amazingly simple in design, construction, and operation, the EC Valve is ideal for sewage and waterworks services. Sizes available now are ½″ through 12″ with larger sizes on application; working pressure – 150 lbs.

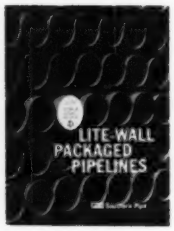
W-K-M Division of ACF Industries, Inc.



426—Steam Specialties

Bulletin SS-140-C contains detailed data on Strong's extensive line of in-line steam traps, strainers, and pressure reducing valves. Applications, detailed specifications, list prices, and cutaway drawings are included, along with the wide range of fitting sizes, materials, and temperature and pressure capacities.

Strong, Carlisle & Hammond.



427—Packaged Pipelines

Bulletin 559 describes Southern Pipe's *Lite-Wall* packaged pipelines for the oil and gas industries. Gives five ways this pipe cuts costs. Explains *Lite-Wall* welding process. Specialized engineering, production facilities, coatings, warehousing, and delivery schedules are included. Specifications on 3½ to 14 in. diameters.

Southern Pipe Div., U. S. Industries, Inc.

428—Corrosion Resistant Valves

Bulletin 802D describes Rockwell's compact, diaphragm-disc type, valve, Penton coated for corrosion resistance, with pneumatic operator. A low cost packaged unit resistant to most chemical fluids to 180°F. Features are outlined. Line drawing shows operation of automatic valve. All valves illustrated.

W. S. Rockwell Co.

429—Disc Liquid Filters

Bulletin 7C, 16 pages, illustrates and describes the full line of crenulated laminated disc liquid filters for removing small micron-size foreign solids from most liquids in one pass through at a rate of 1 gpm at 1 psi pressure drop to 1260 gpm at 3 psi pressure drop, of 35 ssu viscosity fluid.

William W. Nugent & Co., Inc.

430—Lubricated Plug Valves

Catalog PV-5 shows the full line of Powell steel and semi-steel lubricated plug valves, wrench and gear operated. The various types are illustrated in color; and available sizes, pressures, and complete dimensions are given. Accessories, lubricant recommendations, and maintenance suggestions included.

Wm. Powell Co.

PIPING, VALVES & PLUMBING SUPPLIES *continued*

431—Gate Valves

Supplement H to Catalog VC-3 gives complete information on the new Husky gate valve. Valve can be throttled like a globe valve. Use includes water, oil, or gas. Temperature range in continuous operation is 40 F to 250 F. Rating and pressure tables are included. Cutaways show construction, components noted.

NIBCO Inc.

432—Gas Meter Stops

Bulletin 9000 describes the Mueller 500 pound *LubOseal* stop-ductile iron for working pressures to 500 psi. Stops are tamperproof and feature quad rings and triple sealed lubricating port. Bulletin also describes 125 pounds *LubOseal* stops. Features are described and illustrated. Specifications included.

Mueller Co.

433—Flexible Gaskets for Coupling

Technical brochure describes and illustrates the use of Hamilton Kent's "Tylox C-R" flexible gaskets for coupling recessed pipe of all sizes. Gaskets are of a special cross-sectional design to prevent distortion as pipe is coupled. Diagrams show how gasket works. Photographs show method of installation.

Hamilton Kent Manufacturing Co.

434—Bronze Gate Valves

Bulletin 573 shows the many new construction features of the Kennedy 125-lb. gate valve in cylindrical body construction. Cutaway shows construction and operation. Additional features include new hex end design, Kenalloy stem and handwheel. Conform to Federal Specifications WW-V-54 Type 2 Class A.

Kennedy Valve Mfg. Co.

435—Drinking Water Facilities

Haws catalog gives fully detailed information and specifications for complete Haws line of drinking fountains, electric water coolers, deck-type fountains, emergency eye-face wash and drench shower equipment, Haws-Kramer flush valves, laboratory fixtures, miscellaneous faucets, fixtures, accessories and parts.

Haws Drinking Faucet Co.

436—Hydraulic Check Valves

Bulletin WS-1A describes the G-A Double Cushioned Check Valve that prevents damaging hammer and shock due to back surge. Installation is recommended on boiler feed lines, steam pumps, compressors and reciprocating pumps. Water, oil, gas and other fluids can be handled. Technical illustrations.

Golden Anderson Valve Specialty Co.

437—Butterfly Valves

Bulletin 5904 is a comprehensive 36-page catalog on Darling-Pelton rubber seated butterfly valves and operators. Catalog contains information on Darling-Pelton valves, designed in accordance with AWWA specifications for hydrostatic operating pressures up to 125 psi and velocities up to 16 feet per second.

Darling Valve & Manufacturing Co.

438—Glass-Lined Sewer Pipe

Folder deals with the glass-lined sewer pipe with a mechanical joint. *Amvit Glas-Glaz* pipe is available in 4-ft lengths. It is root and infiltration proof and is glass lined inside and out. The pipe has been designed for an under-the-house drain and also as a house-to-street sewer. Assembly operations shown.

American Vitrified Products Co.

439—Bronze Gate Valves

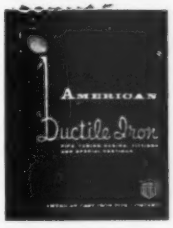
Long service life and easy repairability are features of the 200 and 300-Pound bronze gate valves described by new Bulletin AD-2422. Valves feature alloy seat rings of Crane *Exelloy*, and have a rugged, modern body design. Sizes from ¼-inch to 3-inch. Bulletin gives complete description and specifications.

Crane Co., Industrial Products Group.

440—Bar Stock Valves

Bulletin DH-766-B, giving complete information on R-P&C bar stock valves. Available in a range of metals and sizes for applications requiring close control valves capable of withstanding a wide range of working temperatures and pressures. Completely illustrated.

American Chain & Cable Co., Inc.
R-P&C Valve Division



441—Iron Pipe, Tubing, and Fittings

Catalog L-127 describes the complete line of American ductile iron pipe, tubing, casings, fittings, and special castings. Includes valuable technical information; grades, specifications, dimensions, and weights. Typical applications include underground piping, industrial piping, well casing, and many others.

American Cast Iron Pipe Co.

442—Valves

Bulletin V-1 describes in condensed form the various types of valves manufactured by Schutte & Koerting. Outlined in detail are check valves, back pressure valves, reducing valves, butterfly valves, bypass valves, and instant-acting valves. Other S-K valves are listed. Line drawings show operation of various valves.

Schutte & Koerting Co.

PIPING, VALVES & PLUMBING SUPPLIES *continued*

443—Stainless Steel Fittings

This 22-page catalog explains how Speedline stainless steel fittings reduce piping costs by allowing the designer to take advantage of the new and more economical schedules 5 and 10 stainless steel pipe. A schematic drawing illustrates industrial applications.

Speedline Fittings Division
Horace T. Potts Co.

444—Bronze Valves

New circular shows 150, 200, 300-pound bronze valves that offer such adaantages as: full flow with least pressure-drop and turbulence, 500 Brinell stainless steel seats and discs, long life, little maintenance. Can be furnished with indicator arm, collar, and V-port disc for accurate visual control.

Wm. Powell Co.

445—Entrainment Separators

Bulletin 810A contains information on low cost centrifugal "T" type entrainment separators. Explains the advantages of the new type separator. Included are selection and capacity charts for both air and steam, complete specifications for three types of separators, and charts of separator and trap recommendations.

Wright-Austin Co.

446—Rubber Seat Butterfly Valves

Bulletin 10J is a new catalog describing the new *Monoflange* Mark II rubber seat butterfly valve. The catalog has been designed to be the ideal working tool for engineers and users of this type equipment. Complete specifications, flow data, certified drawings, weights, freight rates, and prices are included.

Henry Pratt Co.

447—Pipe Line Strainers

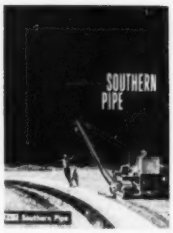
Manual 957 describes complete line of Zurn LPD low pressure drop pipe line strainers. Covers in detail *Duplex, Sinlex,* and Y type strainers plus a section on special purpose pipe line strainers. Includes photographs, engineering drawings, dimensions, and pressure drop charts. Proper ordering directions.

Zurn Industries, Inc.

448—Turbine Oil Filtering Equipment

Bulletin 14F illustrates and describes Nugent packaged turbine lube oil filtering equipment which consists of gravity type filter with water separating compartment, motor driven oil circulating pump, pressure type oil polishing filter, and sight flow indicator. Photographs and diagrams included.

William W. Nugent & Co., Inc.



449—Southern Pipe Facilities

Brochure SP-13-60 outlines the facilities of Southern Pipe Division of U. S. Industries, Inc. Offered is a complete line of steel pipe, lined and coated, for water, oil, and gas transmission. Fabricated to specifications in sizes from 3½ in. to 48 in. Complete story of Southern Pipe's facilities with pictures.

Southern Pipe Div., U. S. Industries, Inc.

450—Electric-Welded Steel Tubing

This four-page brochure is printed in two colors and gives sizes, weights, and uses of Wheatland Electric-Welded Steel Tubing. Also checklist of ordering information. Covers hot- and cold-rolled mechanical tubing, pre-dipped and hot-dipped galvanized. Illustrated and printed on heavy durable stock.

Wheatland Tube Co.

451—Butterfly Valves

Bulletin 590X offers a valve for piping or equipment where positive, bubble-tight or drop-tight closure is needed at operating pressures to 150 psi. Occupies a small fraction of space needed for gate or globe valves. Manual or automatic control. No fouling and self-cleaning.

W. S. Rockwell Co.

452—Fiberglass Drinking Fountains

Bulletin Cat-460 gives full details and specifications for Haws colorful fiberglass drinking fountains. Lightweight, wall-mounted models are vacuum molded, acid-resisting fiberglass. Color chart shows 6 permanent decorator colors available at no extra cost. Heat and pressure laminated; 1, 2, or 3 bubblers.

Haws Drinking Faucet Co.

453—*Saf-T-Seal* Gate Valve

Principles of operation, dimensional data and other information on the newly introduced W-K-M *Saf-T-Seal* gate valve are described in this bulletin. A companion line to the pressure sealing gate valve, the *Saf-T-Seal* is manufactured in ASA 400 lb and ASA 600 lb, 14″ thru 30″, temperatures to 300°F.

W-K-M Division of ACF Industries, Inc.

454—Cast Iron Pipe

Catalog of cast iron pipe, fittings, fire hydrants, water works gate valves. Specifications, dimensions, and weights of bell and spigot, mechanical joint, flanged pipe, and fittings covered. Mathews Modernized, Mathews Flanged Barrel, and R. D. Wood Swivel Joint fire hydrants described. Also Wood gate valves.

R. D. Wood Co.

PIPING, VALVES & PLUMBING SUPPLIES *continued*

455—Fabricated Pipe Fittings

Bulletin 525 illustrates standard and special fabricated fittings which help in planning piping and equipment layouts. Data includes specifications and prints on standard fittings for lightweight pipe. The bulletin also illustrates special fabrications designed to save time and labor.

Naylor Pipe Co.

456—Curb Valves

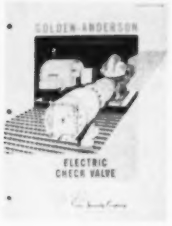
Bulletin 9010 describes the Mueller *Oriseal* curb valve. This ideal curb valve features easy turning after prolonged idleness, lifetime pressure sealing, long cycle life, and permanent lubrication without grease. Features are illustrated with full color cutaway and described. Specifications included.

Mueller Co.

457—Jointing Flexible Gaskets

Technical brochure describes and illustrates the use of "Tylox C" and "C-P" sewer pipe jointing flexible gaskets. Gaskets are for single or double offset pipe of all sizes. Diagrams show gaskets properly positioned and under full compression. Photographs show installation procedures. Coupling methods diagramed.

Hamilton Kent Manufacturing Co.



458—Electric Check Valves

Bulletin W-10A describes the G-A Electric Double-Cushion Check Valve that does not open until pump comes up to speed. Starts closing while pump is running, and when 95% closed, shuts down pump, eliminating shock. Includes ordering requirements, dimensions on globe and angle cross-section views.

Golden Anderson Valve Specialty Co.

459—Ball Float Traps

Bulletin SS46 describes complete line of Strong continuous flow ball float traps. Application data, list prices, detailed specifications, dimensions, cutaway drawings, capacities, and installation diagrams are included. New steel and semi-steel side-inlet models, with wide pressure-temperature limits included.

Strong, Carlisle & Hammond.

460—New Flex Gate Valves

Crane Flex Gates, the most significant gate valve development in 25 years, are the subject of this new bulletin. Flex Gates have many advantages over conventional, solid wedge disc gate valves in the control of oil, water, steam, and other fluids. Bulletin AD-2426 gives complete information and specifications.

Crane Co., Industrial Products Group.

461—Solder Joint Valves

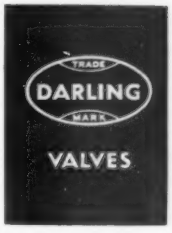
Bulletin 581 describes the uses and construction features found in Kennedy solder joint valves for copper tubing installations. Cutaways, keyed to copy, show operation. Also gives detailed dimensions and instructions on installation. These valves for use on types K, L and M copper tubing.

Kennedy Valve Mfg. Co.

462—Vitrified Clay Pipe

Jointed vitrified clay pipe known as *Amvit*, with a built-in mechanical joint made from polyvinyl chloride, is described in four-page folder. Advantages such as infiltration prevention, quick installation, immediate backfilling, better flow, shock absorption, and quick testing in the field are pointed out.

American Vitrified Products Co.



463—Gate and Check Valves

Catalog 57 describes Darling's line of gate valves and check valves in iron, bronze, steel, and special alloys for all types of valve application. Also included are fire hydrants and accessories for fire protection. This 244 page bound volume gives specifications; pictures facilities; and illustrates product applications.

Darling Valve & Manufacturing Co.

464—Steel Welding Fittings

Catalog H-2 provides information about the complete Husky line of carbon steel welding fittings for schedule 40 piping. Included are eccentric and concentric reducers, 45 and 90 elbows, and straight and reducing tees. Shows 18 buildings in which Husky fittings have been installed. Completely illustrated.

NIBCO Inc.

465—Pressure Sealed Steel Valves

Bulletin DH-400 describes and gives detailed information on R-P&C pressure sealed bonnet joint cast steel valves especially adapted for high pressure, high temperature steam service. Advantages are outlined. Cutaways show construction and operation. Dimensions included.

American Chain & Cable Co., Inc.
R-P&C Valve Division

466—River Crossing Pipe

Booklet L-115 describes American *Molox* ball joint pipe for river crossings and other difficult installations. Map shows various locations of installations. Gives description, suggestions for use, method of assembling. Many pictures are used showing actual installing of pipe. Complete specifications on all diameters.

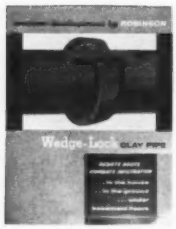
American Cast Iron Pipe Co.

PIPING, VALVES & PLUMBING SUPPLIES *continued*

467—Condensed Valve Catalog

This new valve catalog digest furnishes the latest coverage of the OIC bronze, iron, cast steel, forged steel, and lubricated plug valve lines in a condensed form. Classified by type and pressure class, and illustrated, this edition also includes face to face dimensions for each size and type of valve listed.

Ohio Injector Co.



468—Wedge-Lock Clay Pipe

Bulletin R-359-87 describes Robinson's *Wedge-Lock* clay pipe. Shows how it provides tighter joints to resist roots and combat infiltration in the house, in the ground, and under basement floors. Installation procedures for *Wedge-Lock* factory-made joints are illustrated. Line of fittings pictured. Applications given.

Robinson Clay Products Co.

469—Insulated Piping Systems

The new edition of the Ric-wiL product catalog covers construction features for prefabricated, insulated piping systems for steam, hot water, oil, or refrigeration distribution lines. Types of systems covered include *Hel-cor, Uniline, Type* J, and cast iron. Prefabricated accessories are also included.

Ric-wiL, Inc.

470—Vitrified Clay Pipe

Bulletin PS-101 describes Kaul Clay Company's *Presto SEAL* vitrified clay pipe. Socket and spigot ends are factory-molded polyester, with a rubber gasket permanently imbedded in the socket end. When socket and spigot ends of pipe are joined, a perfect, permanent, flexible seal is made in seconds.

Kaul Clay Co.

471—Plastic Pipe Systems

Handbook 1159 describes plastic ball valves, check, foot, 3-way cock, needle, and globe valves made in five basic materials to handle a wide range of corrosive chemicals at temperatures up to 250°F. Working pressure at various temperatures charted and five basic materials rated as to chemical resistance.

Chemtrol.

472—Snow Melting Systems

"Steel Pipe Snow Melting and Ice Removal Systems," 32 pages, presents the case for snow melting systems and shows typical installations in commercial and industrial locations. Design data is complete with information on anti-freeze mixtures, sizes, and spacing.

Committee on Steel Pipe Research, American Iron and Steel Institute.

473—Water Works Brass Goods

Water works brass goods bulletin WW-58 illustrates and describes McDonald water service products. Included are curb stops, corporation stops, goosenecks, meter stops and couplings, service pipe couplings, and extension service boxes. Each product offered is pictured with description and necessary specifications.

A. Y. McDonald Mfg. Co.

474—Precision Control Valves

Catalog A243 describes all types of precision control valves manufactured by the Kohler Co. Cutaways and exploded views show construction and operation of various types of valves. Sizes and engineering data in table form is included. The many valve applications are listed. Branch sales office addresses given.

Kohler Co.

475—Cemented Wells

Bulletin 600 describes installation, application, and uses of cemented wells. A diagramatic drawing of this type pump illustrates how the source of water supply can be protected from contamination by surface seepage. Pictures show installation and cutaway shows construction and component parts of pump.

Layne & Bowler, Inc.

476—Pyrex Drainline Systems

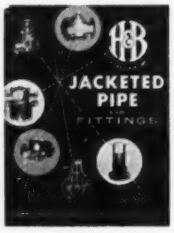
Bulletin PE-30 describes Corning Glass Works' *Pyrex* brand lifetime drainline system, guaranteed against corrosion and leakage for the life of the building. Specifications, fittings, and sizes are shown in table form and diagram. Simple installation procedures illustrated and described. Distributors listed.

Corning Glass Works.

477—Sewer Joint Compound

Bulletin M20-1 describes the properties of Atlas G-K sewer joint compound and gives detailed instructions for its use under any circumstance. An easy-to-follow comparative chart is also included indicating qualities of G-K needed per pipe size. A four-page, two-color, illustrated bulletin.

Atlas Mineral Products Co.



478—Jacketed Pipe and Fittings

Bulletin J-57 describes pipe, welded steel fittings, spring loaded plug valves, and valves all jacketed, manufactured by Hetherington & Berner Inc. Different types of valves and fittings are illustrated together with cutaway photographs showing construction and operation. Also jacketed pumps and flexible hose.

Hetherington & Berner Inc.

PIPING, VALVES & PLUMBING SUPPLIES *continued*

479—Non-Corrosive Drainline

Booklet gives all necessary information on Vulcathene integrated drainline system which includes pipe, fittings, traps, and sinks. Includes recommended uses, advantages, characteristics, layout, and design. All types of drainline fittings are illustrated and give dimensional information. Accessories listed.

American Vulcathene Div.

481—PVC Pipe Fittings, and Valves

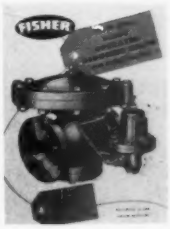
Bulletin of engineering information on PVC plastic pipe, fittings, and valves. Specification, design, and installation information is included as well as a comprehensive corrosion resistance comparison chart for seven types of plastic pipe carrying 162 chemicals. Charts show fluid and gas flow characteristics.

Kraloy Plastic Pipe Co., Inc.

480—Polyethylene Plastic Pipe

Polyethylene plastic pipe is a flexible pipe for both hot and cold water. This bulletin describes its features of economy and durability. Lists its many areas of use, plus the varieties available from Keasbey & Mattison. Industry, agriculture, homeowners, and municipalities are some of its many markets.

Keasbey & Mattison Co.



482—Reducing Valves

Bulletin D-92B describes Fisher Governor pilot operated reducing valves for steam service. Available in sizes from ¼" through 6", with 250 lb screwed connections, and 1¼" through 6" in 125 lb or 250 lb flanged connections. It is a self-contained unit, obtaining pilot operating medium from the inlet.

Fisher Governor Co.

PLANT SITES

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

483—Industrial Opportunities

A colorful new presentation of Colorado's industrial opportunities. Included are booklets on manufacturing, power, raw materials and resources, transportation, markets and labor, Colorado living, industrial site locations, state highway map, and full color recreation booklet. Up-to-the-minute data in portfolio form.

Colorado Department of Development.

POWER EQUIPMENT & FUELS

484—Spreader Stokers

New bulletin 860 illustrates and describes the Detroit *RotoStoker,* a spreader stoker with overthrow rotor feeders. For use with medium size boilers up to about 60,000 pounds of steam per hour capacity. Power dumping, hand dumping, or stationary grates. May be installed in almost any type boiler.

Detroit Stoker Co.

485—Deaerators

Five bulletins describe Cochrane's Uni-Pac deaerators. Information is furnished on cast iron jet-tray deaerators, rolled plate jet-tray units, atomizing deaerators, and horizontal rolled plate atomizing deaerators. General information on selection of deaerator types and need for deaeration also included.

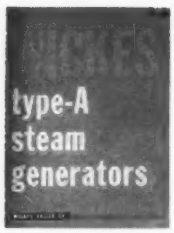
Cochrane Corp.

POWER EQUIPMENT & FUELS *continued*

486—Hot Water Boilers

Bulletin HCC-2, a 20-page brochure, describes and illustrates the design, construction, advantages, and economies of the C-E LaMont controlled circulation hot water boiler for supplying high pressure, high temperature water for heating systems and process applications. Comparison table of heat content.

Combustion Engineering, Inc.



487—Steam Generators

Wickes type-A steam generators, compact, efficient, shop assembled water tube boilers, are illustrated and described in catalog 56-1. It gives typical superheater arrangements for the boilers with section, plan, and side views of drainable "S", pendant, and drainable superheaters. Specifications are given.

Wickes Boiler Co.

488—Stationary Diesel Engines

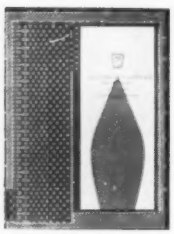
Bulletin 110 describes Models 60 and 80 *Superior* stationary diesels. Four-cycle, 6- or 8-cylinder, in-line models, ranging from 530 to 2000 bhp and from 300 to 1250 kw. Typical applications are water works, sewage plants, power plants, and others. Specifications given.

White Diesel Engine Division,
White Motor Co.

489—Automatic Firing Equipment

Catalog 6260 describes the complete line of Iron Fireman commercial and industrial burners. Included is an "Index and Selection Chart" which enables users to select appropriate equipment based on type of fuel desired and kind of draft. Single or dual-fuel combustion equipment available.

Iron Fireman Manufacturing Co.



490—Packaged Steam Generators

Bulletin PG-58-2 describes automatic packaged boilers, oil or gas fired, available in capacities from 13,000 to 100,000 lb per hr with design pressures from 250 to 1350 psi. Cutaway wash drawing shows construction. Features, standard equipment, and optional equipment listed. Capacities and dimensions charted.

Foster Wheeler Corp.

491—Atomizing Fuel Oil Burners

The Todd *Vee-Cee* type variable capacity mechanical atomizing fuel oil burner for installations with widely fluctuating loads is fully described in four-page bulletin TD56-16X. Bulletin shows special construction that gives uniform, easily oxidized spray, constant pressure, and quick cold starting.

Todd Shipyards Corp., Products Div.

492—Air-Jacketed Silencers

Data Sheet D-192 describes Maxim air-jacketed silencers which not only suppress engine noise to desired levels, but also provide an economical means of ventilating engine rooms and surrounding areas. Line drawings show horizontal and vertical installations.

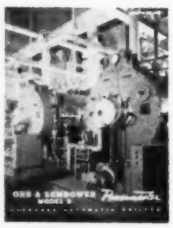
Maxim Division
American Machine & Foundry Co.

493—Water Tube Packaged Boilers

A completely new line of low and high pressure forced-draft water tube packaged boilers is described in bulletin 1400. Known as the *Compak* series, these factory-tested units are offered in 22 sizes ranging in capacity from 12 through 750 horsepower. Engineering specifications with catalog literature.

International Boiler Works Co.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.



494—Oil and/or Gas Fired Boilers

Bulletin 1260 describes and illustrates *Powermaster* Model 3 line. Includes gas, oil and combination gas/oil models, a new specially designed hot water boiler, and the new steam atomizing principle for use with No. 6 oil. Ratings and dimensions of all sizes in line are included. Cutaway shows operation.

Orr & Sembower, Inc.

495—Coal Storage Data

Fuel Engineering Data Section D-3 describes in-plant and outside storage methods applicable to plants burning 500 to 100,000 tons of coal annually. Contains specific instructions on such items as stockpiling, compaction, handling hot coalpiles. Discusses equipment requirements based on tonnage stored.

Bituminous Coal Institute.

496—Hot Water Boilers

Catalog AD 183 describes the Cleaver-Brooks hot water boilers. An engineering report on high velocity flow hot water boiler. Results of extensive laboratory experiments and field testing under actual conditions. Complete packaged units. Line drawings show internal flow and circulation patterns.

Cleaver-Brooks Co.

POWER EQUIPMENT & FUELS *continued*

497—Packaged Hot Water Boilers

Type CC Superior packaged boilers designed for hot water operations and for capacities from 670,000 to 11,720,000 Btu/hr are described in this catalog. Burning gas, oil, or both, the Type CC is equipped with a venturi-action mixing tube which overcomes problems developing from improper boiler circulation.

Superior Combustion Industries, Inc.

498—Industrial, Commercial Burners

Bulletin 1 describes Industrial Combustion's *Hev-E-Oil* burners for industrial and commercial use. These burners are expressly engineered to make use of low-cost, high-heat content heavy fuel oils. Installations are pictured. Cutaway and line drawing show construction and operation. All models illustrated.

Industrial Combustion Inc.

499—Automatic Coal Firing Units

A compact, automatic coal firing unit for installations of 175 hp to 350,000 pounds of steam per hour and upward. Engineered for top efficiency with both low and high ash coals. Exclusive conveyor feeder won't clog and provides even distribution throughout entire range, 50 to 7500 lbs coal per hr.

American Engineering Co.

500—Modular Nuclear Power Plant

Spring-Summer, '60 *Alco Review* features first modular nuclear power plant, the Army PM-2A, built by Alco and being installed this summer in Greenland. Article includes description, story of design and building, and design data. Other articles treat tunneling, wellhead valve, and pipeline diesels.

Alco Products, Inc.

501—Packaged Boilers

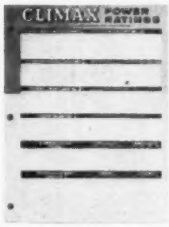
Bulletin B-3456 describes the features of the Titusville-Atlas patented wet back boiler and burner. Designed for high or low pressure, steam or hot water for heating or processing. Cutaway model shows patented wet back and line drawing shows operation. Bulletin B-3456A and B give data on 2- and 3-pass units.

Titusville Iron Works Co.

502—Barrel-Type Boiler Feed Pump

Bulletin 2139-B1 describes and illustrates features of high and conventional speed barrel-type feed pumps. Detailed cross sections show water flow through pump stages, condensate injection sealing arrangement, and axial thrust balancing device. Bulletin explains *Worthington's Feed Pump Design Philosophy.*

Worthington Corp.



503—Engines

Bulletin SA-612-B, a complete listing of all Climax engines and complete power unit ratings showing maximum hp available for bare engines and recommended operating ratings for various applications of power units with accessories. Complete bulletins describing all models shown in the power chart are available.

Climax Engine Manufacturing Co.

504—Blow-Off Valves

Technical article authored by Yarnall-Waring engineer Edward E. Finsel and reprinted from Power Engineer's valve manual. Covers the whole subject of blow-off valves including purpose, code pressure ratings, types, methods of operation and maintenance. Schematic drawings show operation of various valves.

Yarnall-Waring Co.

505—Shot Cleaning System

Bulletin 2145 covers the new Diamond shot cleaning system for the most efficient and economical cleaning of such external horizontal tube surfaces as superheaters, reheaters, economizers, and air heaters. Gives advantages, principles, construction, and operation. Chart shows draft loss from ineffective cleaning.

Diamond Power Specialty Corp.

506—Packaged Boilers

Bulletin WT-101 on Bros Series P packaged boilers is available. Capacities have been increased to a range of 10,000 lbs to 80,000 lbs steam per hr. Standard design pressures of 200 and 250 psi. Cutaway shows construction features with keyed explanations. Complete specifications of each model included.

Bros Inc., Power Division

507—Tray Type Deaerators

Vertical and horizontal tray type deaerators for effective removal of corrosive gases from boiler feed water are the subject of booklet 28B8853. Principles of operation and important features are described. Technical data is presented in handy table form. Effluent capacities from 18,000 to 550,000 lb/hr.

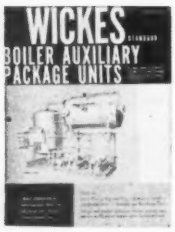
Allis-Chalmers.

508—Packaged Air Preheater

The important points to consider in selecting a preheater for use with small boilers (25,000 to 250,000 lbs per hr) are discussed in four-page bulletin on the new package Ljungstrom air preheater. Explains how preheater saves fuel, increases boiler output and reliability, and permits use of lower grade fuels.

Air Preheater Corp.

POWER EQUIPMENT & FUELS *continued*



509—Boiler Auxiliary Packaged Units

Bulletin 59-1 describes auxiliary package units available for boilers of 10,000 to 100,000 lbs steam per hour, steam pressure to 300 psig. Units have various combinations of deaerating feedwater heaters, boiler feed pumps, condensate surge tanks to reduce maintenance and to increase plant efficiency.

Wickes Boiler Co.

510—Engines and Generator Sets

Complete 80-page catalog includes power curves, sectional drawings, and subassembly photographs of six basic engines in 19 models, a power range of 100 to 2150 bhp. Diesel, gas, and dual fuel engines and generator sets are available as a custom installation.

White Diesel Engine Division, White Motor Co.

511—Waste Heat Recovery

Bulletin WHB 59-3 describes the economic utilization of excess heat developed from diesel exhaust gases and industrial and chemical processes. Specific industrial, marine, and chemical applications of varying capacities and services are illustrated. Advantages of bare tube and extended surface designs are noted.

Foster Wheeler Corp.

512—Complete Packaged Boilers

Twelve-page catalog describes Type AS Superior packaged boilers for capacities from 4000 to 21,000 lbs steam per hr. Complete packages with rotary burners, integrated controls, soot blowers, refractory, and insulation, these units also have quiet rear mounted draft fan which provides air-cooling of furnace floor.

Superior Combustion Industries, Inc.

513—Fuel Burning Systems

Bulletin 1270 describes and illustrates this highly efficient fuel burning system. Will produce a higher guaranteed burner efficiency over a wider range than any other burner system. Air or air/steam atomizing burner and partial premix gas burners are described. For every industrial and commercial need.

Orr & Sembower, Inc.

514—Rotary Burners

Bulletin describes Johnson Model 53 fully automatic, metering pump rotary burners. This burner insures smooth automatic starts even after lengthy shut downs. Will fire on oil only, gas only or combination oil and gas. Available in 9 sizes from 28 hp to 560 hp. Detailed dimensions given.

S. T. Johnson Co.

515—Discharge Silencers

Data Sheet D-180 describes Maxim hi-velocity discharge silencers to handle flows to atmosphere of steam, air, or gas from safety valves, gas turbines, and turbo-charged gas engines. Installation directions on three available models. Drawings show construction.

Maxim Division
American Machine & Foundry Co.

516—Oil-Gas Burner

Form 5808 describes light oil, gas, and dual-fuel oil-gas burner designed for operation against firebox pressure. Fires number 2 fuel oil and/or natural or LP gas. Special burner head produces high combustion efficiency and prevents flame pulsation. Models available for firing pressurized or natural draft boilers.

Iron Fireman Manufacturing Co.

517—Refuse Burners

Catalog 510 describes various methods of burning dry or wet bark, scrap wood, corn cobs, bagasse, spent coffee grounds, and other types of refuse on Detroit RotoStokers and RotoGrate Stokers. Refuse is burned separately or in combination with coal using automatic feeder systems.

Detroit Stoker Co.

518—Municipal Engines

Bulletin SA-631 describes the complete line of Climax engines built for municipal plant service. These engines, from six to twelve cylinders and from 60 to 600 hp, are available for all sewage and water treatment plant applications. Climax engines are noted for simple, rugged construction and smooth operation.

Climax Engine Manufacturing Co.

519—Packaged Boilers

Catalog VP-3, 16 pages, describes the new Type VP package boiler. Following a section of background information is an outline of principal design features. These boilers are shop assembled and provide steam capacities from 4000 to 90,000 lb per hr. Space requirements and specifications are in table form.

Combustion Engineering, Inc.

520—Packaged Demineralizers

Bulletin 5819-A describes a new line of standardized *Uni-Pac* packaged demineralizers. Available in units ready to connect and operate in sizes from 2100 to 13,200 gal/hr. Includes photographs, specifications, and drawings of typical units. Size, regenerant requirements, and operating data on four standard models.

Cochrane Corp.

POWER EQUIPMENT & FUELS *continued*

521—Automatic Boiler-Burner Plant

Bulletin 4 describes the simplicity, easy maintenance, adoptability, and guaranteed field performance of the Highlander, two-pass, Scotch type boiler-burner plant. A general description is illustrated in line drawings to show construction and operation. Data for each model shown in tabular form.

Industrial Combustion Inc.

522—Estimating Power Plant Costs

Engineering Data Section B-5 explains quick method of approximating construction costs for boiler plants (to 1 million lb/hr capacity) and electric-generating facilities to 100,000 kw. Costs over all components. Booklet contains two logarithmic graphs, with full explanation and typical examples.

BCI Dept., National Coal Association

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

523—Vibra-Grate Stoker

Catalog S-546-A describes and illustrates American Engineering's water-cooled vibrating grate stoker in sizes from 25,000 to 150,000 pounds of steam per hour. Even at low rating does not require dust collector and assures freedom from smoke. Burns low grade coals at top efficiency. Adaptable to oil or gas.

American Engineering Co.

524—Packaged Boilers

Bulletin AO 184, describes the CBH packaged boiler. Tailored for heating and processing loads in 25 through 100 hp range. Four-pass, forced draft design, light oil, gas or combustion oil/gas fired. Cutaway shows design, construction, and operation. Line drawings show burner operation and water circulation.

Cleaver-Brooks Co.

525—Packaged Steam Generators

Bulletin B-3255 describes Titusville's Type WTP packaged steam generators with steam capacities from 10,000 lbs to 60,000 lbs per hour. Construction, performance, and maintenance are discussed. Outstanding features given. Bulletin B-3255-A includes line drawings and specifications on various sizes.

Titusville Iron Works Co.

526—Diesel Engines

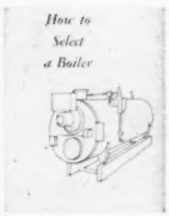
Bulletin DE-6 describes Alco 251 diesels. Available in three sizes, Six, Vee 12, and Vee 16 and ratings from 550 to 2400 hp. Cutaway of Vee model shown together with illustrations and descriptions of components. Diagrams of In-line 6, Vee 12, and Vee 16 with dimensions and specifications.

Alco Products, Inc.

527—Forced Recirculation Generators

Advantages of International-LaMont high temperature water generators are described in bulletin 1600. Engineering data section gives factual comparison between HTW and high pressure steam systems along with pertinent cost considerations. Typical pressurization and pumping arrangements discussed.

International Boiler Works Co.



528—Boiler Selection

Catalog AD 173, "How to Select a Boiler," offers valuable suggestions to the consulting engineer and the architect on just what to look for when selecting a boiler. For example: first costs vs operating costs, packaged boiler vs the built-up boiler, and boiler design standards. Completely illustrated.

Cleaver-Brooks Co.

529—Packaged Steam Generators

New six-page bulletin entitled "More Performance From Less Investment" describes in detail Cyclotherm's line of 18 sizes of package steam generators, 15 hp to 650 hp. Also specifications on 10 sizes of new package hot water generators, 670 mbh to 6700 mbh. Cutaways and line drawings show operation.

Cyclotherm Division of Crane Co.

530—Induced Draft Bifurcator

Bulletin DB-44-56 describes DeBothezat's induced draft bifurcator, which provides instant, adequate draft eliminating costly stacks. Construction features are listed and illustrated with cutaway. Installation photographs, boiler code ratings, selection data, dimensional drawings.

DeBothezat Fans, Division of American Machine & Metals, Inc.

531—Continuous Blowdown System

Bulletin 8001-A features the *Total Function* automatic boiler blowdown and sampling system completely packaged and pre-engineered to handle, two, three, or four boilers 250-600 lbs working pressure, capacities up to 6,000 lbs/hr blowdown. Illustrates operating components of console and basic designs.

Fred H. Schaub Engineering Co.

POWER EQUIPMENT & FUELS *continued*

532—Diesel Engines

Bulletin 40-20169 describes diesel engine power by Caterpillar. Includes specifications and illustrations of four-cycle diesels for any job, modern power plants with compact generators, and marine engines for continuous duty. Engines and attachments adaptable into engine packages for special needs.

Caterpillar Tractor Co., Engine Division.

533—Forced-Draft Burners

Bulletin describes compact forced-draft package unit burner. This single, coordinated, factory-tested assembly, ready for attachment to boiler, combines all necessary equipment for burning oil or gas fuels. Gives details of design and features. Diagrams are keyed to chart giving dimensions for all models.

S. T. Johnson Co.

534—Rotary Oil Burners

The new Todd Series B rotary fuel oil burners are summarized in four-page bulletin TD56-82X. It includes a burner size selector chart and lists 11 advanced design features of seven basic sizes rated from 400,000 to 22,500,000 Btu per hr, with oil capacity from 3 gal per hr to 150 gal per hr.

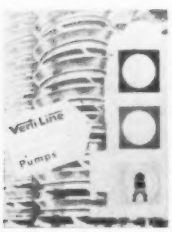
Todd Shipyards Corp., Products Div.

535—Wormfeed Stokers

Bulletin 559 describes Canton's *Duraflex* wormfeed stokers for bituminous and anthracite coal. Included are specifications and ratings for bituminous coal, descriptive drawing showing assembly and method of feeding, components of the feeding assembly, model boiler room plan, and the many features of the stoker.

Canton Stoker Corp.

PUMPS & COMPRESSORS



536—Close-Coupled Industrial Pumps

Bulletin 1100 describes Layne & Bowler's *Verti-Line* close-coupled industrial pumps. Capacities from 20 gpm to 30,000 gpm, heads to 600 psi. Features illustrated and described. Line drawing shows components, and cutaway shows construction. Head-capacity range table, material specifications, and installation photographs.

Layne & Bowler Pump Co.

537—Centrifugal Pumps

Bulletin 110 describes Weinman Types LB and LLB single stage, double suction, split case centrifugal pumps for circulating and booster service. Pumps have 140 to 340 gpm ratings, at 20 to 150 ft heads. Bulletin gives sectional view with keyed parts list, specifications, and performance curves.

Weinman Pump Manufacturing Co.

538—Manual of Pumping Problems

"How to Solve Pumping Problems," 36-page instruction manual, covers important fundamentals of estimating requirements of the average pumping job. It contains sample problems on hydraulic systems, general transfer, and pressure transfer, plus tables, charts, and other pertinent engineering data.

Roper Hydraulics, Inc.

539—Rotary Positive Blowers

Series 400 and 600 rotary positive blowers, gas pumps, and vacuum pumps are described in bulletin S-65C, including dimension drawings and cutaways. Volumes up to 20,000 cfm single stage with pressures to 10 psi or vacuums to 20 in Hg. Features anti-friction bearings and wide-face herringbone timing gears.

Sutorbilt Corp.

540—Submersible Water Pumps

Bulletin B1300 describes Sumo's industrial size submersible water pumps from 3 through 125 hp at 3550 and 1750 rpm. Heavy duty pumps used for municipal water supply and booster systems, industrial and commercial buildings, institutions, and irrigation. Features are pointed out in cutaway photograph.

Sumo Pumps, Inc.

541—Power Plant Pumps

Bulletin C107 gives everything needed by the engineer in his selection of power plant pump requirements up to 100 gpm and 800 ft tdh. Included in this 44 page bulletin is speed conversion ratios, performance curves, the NPSH formulae, and mechanical loading limits on two-stage turbine power plant pumps.

Roy E. Roth Co.

PUMPS & COMPRESSORS *continued*

542—Condensation Pumps

Bulletin 14-B describes the "HS" condensation pump by Skidmore Corp. which is designed to give greater efficiency at a lower operating cost. Pump is connected to motor through a heavy type flexible coupling. Float switch can be removed from receiver as complete unit, easily adjusted to water levels.

Skidmore Corp.

543—Industrial Pumps

Catalog describes uses and construction of new *FloWay* line of industrial pumps manufactured by Fiese & Firstenberger. Capacity range is from 15 to 4000 gpm. *FloWay* vertical turbine pumps are designed for every industrial and municipal pumping need and for every pumping condition.

Fiese & Firstenberger Mfg., Inc.

544—Ejector Guide Book

Bulletin 4520-B1 describes complete line of ejectors from Worthington Corp. Sections cover: principle of ejector operation; components employed with ejectors to make a system; ejector advantages; terminology; ejector limitations; process and industry applications. Data on application of ejectors to six stages.

Worthington Corp.

545—Propeller Pumps

Bulletin 1024A describes the improved line of large volume propeller pumps designed for all heavy duty uses. For low lifts from 2 to 40 feet with capacities from 500 to 100,000 gpm. Bulletin contains construction details, cutaway of pump with callouts, dimensions with line drawings, specifications, other data.

Johnston Pump Co.

546—Rotary Compressors

Inherent advantages of rotary compressors for such applications as shop air, drilling, and gas handling are described in four-page bulletin 16B8244. Construction and operational details, dimensions, and ratings of two-stage, sliding vane compressors for 250 to 1800 cfm at pressures from 60 to 125 psig.

Allis-Chalmers.

547—Industrial Pumps

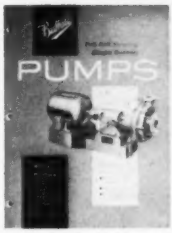
Bulletin describes Byron Jackson's complete line of centrifugal pumps designed for every industrial pumping requirement. Actual installations of all major types of centrifugal pumps are shown. Included are general capacity ranges and conditions.

Byron Jackson Pumps, Inc.
Subsidiary of Borg-Warner Corp.

548—Pumps and General Services

Bulletin 100, condensed list of services pertaining to water well systems, pumps, drilling, allied services, and equipment. Includes water wells, oil and water lubricated vertical turbine pumps, well screens, special pumps for many uses, irrigation, special drilling, water treatment, and service work.

Layne & Bowler, Inc.



549—Single Suction Pumps

Bulletin 976-G gives complete specifications on full ball bearing single suction pumps. Use includes handling saturated refrigerants and saturated liquids in air conditioning, viscous fluids in petrochemical and process industries, corrosive liquids when of alloy construction, and many others.

Buffalo Pumps Div., Buffalo Forge Co.

550—Abrasive Liquid Pumps

Folder SP-507 describes the complete new line of Viking abrasive liquid pumps. New ceramic bearings and mechanical seals incorporated in this equipment has doubled and tripled the pump life when handling paints and inks, as well as other abrasive materials. Folder includes specifications, and dimensions.

Viking Pump Co.

551—Turbine Pump Motors

A new turbine pump motor designed especially for short-coupled industrial pumping is described in bulletin F-1975, "U. S. Unibase Turbine Pump Motors." New microset coupling avoids disassembly for pump fine adjustment. Motor base, coupling all are factory aligned, tested package.

U. S. Electrical Motors, Inc.

552—Rotary Gear Pumps

Bulletin G-3 describes line of internal and external bearing type *Gearex* pumps for handling materials up to 5,000,000 SSU, capacities to 650 gpm., pressures to 350 psi. Horizontal, vertical submerged, vertical dry, high temperature, and jacketed body types included. Covers applications, dimensions, capacities.

Sier-Bath Gear & Pump Co., Inc.

553—Jet Pumps

Bulletin 512R describes jet pumps that will perform a wide variety of pumping operations. The principle of jet pump operation is explained in detail. Line drawings show pump design. Capacity charts and specifications are given for various models. Schematics show typical arrangements and applications. Special pumps.

Penberthy Mfg. Co.

PUMPS & COMPRESSORS *continued*

554—General Service Pumps

Bulletin 100 gives complete data on the Weinman Type AC general service *Unipump* for pressure boosting service, hot and chilled water circulation, and other general pumping requirements. Bulletin includes drawings, dimensions, performance chart, and pump selection table for the many available models.

Weinman Pump Manufacturing Co.

560—"CCVS" Pumps

Bulletin 21-C describes the new, improved Skidmore "CCVS" pumps. These pumps offer a capacity range from 500 to 10,000 sq ft EDR and discharge pressures from 20 to 40 lbs. The new single units are built in three sizes having 5, 10, and 20 gallon receivers. Includes features, construction, engineering data.

Skidmore Corp.

555—Pumps and Blowers

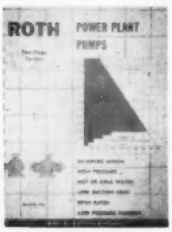
California series rotary positive blowers, gas pumps, and vacuum pumps are described in bulletin S-59G with dimension drawings and capacity tables. For volumes up to 2480 cfm single stage with pressures to 10 psi or vacuums to 20 in. Hg. Features anti-friction bearings, wide-face timing gears, oil-free.

Sutorbilt Corp.

561—Jet Apparatus

Bulletin J-1 describes the various kinds of jet apparatus manufactured by Schutte & Koerting for syphons, eductors, heaters, blowers, exhausters, compressors, scrubbers, condensers, pumps, and other types of equipment. Each application explained with cutaway drawings showing operation. Gives details.

Schutte & Koerting Co.



556—Turbine Power Plant Pumps

Bulletin 107A gives complete technical data on two-stage turbine power plant pumps. Includes details of construction, installation dimensions, range, applications, optional mechanical seals, and NPSH ratings. Also includes selection tables on pumps of capacities ranging from 5 gpm to 100 gpm, 100 to 800 ft tdh.

Roy E. Roth Co.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

557—Mixed-Flow Pumps

Bulletin describes a new line of large volume pumps for medium lifts from 20 to 80 feet, with capacities that exceed 100,000 gpm. Engineered for industrial, agricultural, and municipal use. Bulletin contains construction details for both pump and systems, cutaway, specifications, material tables, and other data.

Johnston Pump Co.

562—Quality Pumps for Every Service

A new bulletin describing the quality control and special test procedures involved in manufacturing BJ pumps. Also shows typical pump installations for boiler feed, pipeline, and high pressure pumping; nuclear pumps; refinery, chemical, and process pumps.

Byron Jackson Pumps, Inc.
Subsidiary of Borg-Warner Corp.

558—Submersible Pumps

Bulletin B-259 describes the new design of the Super-Sumo submersible pump for 4" and larger wells. Designed for economy installations, the pump features bronze and stainless steel construction for corrosion resistance, long life, and maximum pumping capacity. Sizes from 1/3 hp to 1½ hp, capacities to 1700 gph.

Sumo Pumps, Inc.

563—Vertical Turbine Pumps

Bulletin 900 completely describes the facilities of the Layne & Bowler Pump Co. The Verti-Line pump made today represents 50 years devoted to the design, engineering, production, and improvement of vertical turbine pumps. Typical fields where Verti-Line pumps are in service shown. Types of pumps pictured.

Layne & Bowler Pump Co.

559—Rubber Lined Pumps

Bulletin 981 describes features and advantages of all rubber-lined pumps. For use with many corrosive liquids including chlorinated brines, sodium chloride, Potassium chloride, brine slurries, hypochlorous acid, hydrochloric acid, chlorinated paper stock, caustic soda, hydrofluoric slurry, and others.

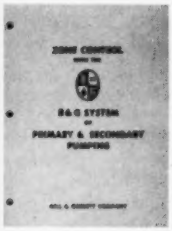
Buffalo Pumps Div., Buffalo Forge Co.

564—Cyclone Separator, Aftercooler

Bulletin 714 describes in detail the advantages and the use of the R. P. Adams cyclone separators and pipe line aftercoolers in maintaining clean, dry compressed air supplies. It is complete with engineering tables, color diagrams, and installation photographs which dramatically illustrate advantages.

R. P. Adams Co., Inc.

PUMPS & COMPRESSORS *continued*



565—Primary and Secondary Pumping

A completely automatic system for year 'round temperature control of a large multi-zoned building can present challenging design problems. A helpful solution "Zone Control with the B&G System of Primary and Secondary Pumping" is presented in an interesting 24-page design manual. Diagrams show systems.

Bell & Gossett Co.

566—Turbine Pump Drives

Bulletin 31 describes Johnson's right angle turbine pump drives, in standard and combination drive installations, in a wide range of models to meet specific requirements of prime movers and pumps. Introduces new *Redi-Torq* automatic combination drive. Includes illustrations, power ratings, and average efficiencies.

Johnson Gear & Manufacturing Co., Ltd.

567—Grout Pumps

Bulletin WS-150 contains data and specications on grout pumps, the only Simplex type for grout, slush, mud, and other heavy viscosity liquids. Pumps feature simplified heavy-duty design and can use air, steam, gasoline, diesel, electric motor or turbine drives.

Wagener Pump Div., Canton Stoker Corp.

568—Motor-Mounted Pumps

Bulletin SP-509 describes the new line of small motor-mounted Viking pumps available in ½, 1½, and 3 gpm sizes integrally mounted with 1750 rpm motors. Pumps are suitable for handling liquids up to 7500 ssu and up to 500 psi handling lubricating oils and fuel oils above 100 ssu. Specifications.

Viking Pump Co.

569—Vertical Turbine Pumps

Bulletin 11 describes *Watermaster* vertical turbine pumps. These pumps have the same precision engineering and high qualities that characterize high capacity pumps by Fiese & Firstenberger. They cover a wide range of uses where the need is for relatively small capacities, from 15 gpm to 125 gpm.

Fiese & Firstenberger Mfg., Inc.

570—Rotary Pumps

Catalog 958B contains detailed illustrations of several models in each of the five major series of Roper heavy-duty industrial pumps. Capacities, dimensions, performance and application data, and illustrated major features for each series are supplied. Roper custom pumps and pump-motors are also featured.

Roper Hydraulics, Inc.

STRUCTURAL MATERIALS & EQUIPMENT

571—"T-1" Steel Data

Booklet 01060 describes USS "T-1" steel, one of the most important members of the alloy family to appear on the scene in years. Contains cost comparisons, complete engineering data, metallurgical characteristics, fabrication practices, and applications. Profusely illustrated to show uses. Cuts costs, increases performance.

U. S. Steel Corp.

572—Seals and Gaskets

Four-page bulletin SG-659 covering complete line of *Weathertite* seals for various types of control joints in block constructed walls. It also covers masonry gaskets of nonabsorbent elastomer for use between sill and coping stones, brick or stone wall panels, and masonry and structural steel members.

Williams Equipment & Supply Co.

573—Textured Masonry Coating

Bulletin BP3063 describes *Hydrocide Colorcoat*, an advanced concept in a one coat all-weather protective and decorative coating for most masonry surfaces. The 11 modern colors in which *Colorcoat* is available is shown on one full page. Complete specifications and application directions are also included.

Sonneborn Chemical & Refining Corp.

574—Underfloor Distribution Systems

Bulletin 513 contains drawings, part numbers, and photographs of the three *Spang* duct systems for power, telephone, and intercom. Underfloor duct (for regular slab construction), headerduct (for cellular floors), and industrial duct (large capacity for heavy requirements in phone and intercom systems). Fittings described.

National Supply Co.

STRUCTURAL MATERIALS & EQUIPMENT *continued*

575—Fire-Resistant Columns

Catalog covers the new concrete filled, double shell, fire resistant columns as manufactured by Tubular and approved by Underwriters' Laboratories, Inc. Specifications and cross-section sketches are provided for round, square, and rectangular tube columns. Contains comprehensive design details and sample computations.

Tubular Products, Inc.

576—Long Span Steel Decking

Installation data and detail drawings are given in 16-page catalog LSD-58 for use of long span M-decks. They have been especially designed to provide a better balanced, more efficient structural unit for roof and combined roof-ceiling construction. Includes acoustical treatment and lighting.

R. C. Mahon Co.

577—High Strength Bearing Bolts

Engineering bulletin describes new high strength bearing bolt with highest sheer strength, greatest resistance to slip of all structural bolts. Advantages in design, in erection, and in structure outlined. Dimensions, comparison data, grip chart. Distributed by all Steel Service Centers of U. S. Steel Supply.

Lamson & Sessions Co.

578—Rolling Counter Shutters

Bulletin 107 describes the Kinnear rolling counter shutters with midget slats. These metal shutters provide protection against weather, pilfering, or illegal entrance. Section views and diagrams show complete details and dimensional data. Manual or crank operated. Custom built to fit any opening.

Kinnear Mfg. Co.

579—Galvanized Roofing and Siding

Bulletin ADUCO-30305 describes 1¼ in. and 2½ in. corrugated, 5-V crimp and *Stormseal* galvanized steel sheets. Advantages are listed. Roofing accessories pictured and described. Section on installation procedures together with 14 application tips. Method of computing and table of weights included.

U. S. Steel Corp.

580—Complete Floor Maintenance

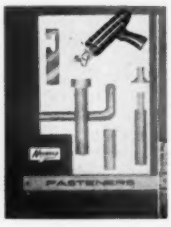
Bulletin in simple tabular form covers the hardening, resurfacing, patching, and coating of new and old concrete or wood floors. Included are methods of application, preparation, coverage, and type of product. Includes protection factors, resistances, and time required.

A. C. Horn Companies,
Div. Sun Chemical Corp.

581—Steel Roof Deck

Catalog 240 describes Inland's 5 broad lines of steel roof deck including new T-steel for spans to 32 feet. Included are features, section properties, load tables, construction details, installation procedures, and accessories. Information on *Acoustideck*, a roof deck and acoustical ceiling, is also presented.

Inland Steel Products Co.



582—Stud Welding Equipment

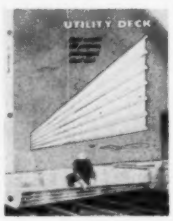
The Consulting Engineer's file folder contains literature describing the use of Nelson stud welding equipment for concrete anchoring devices and other structural fasteners. Includes data on welded stud fasteners, concrete fasteners, and powder actuated fasteners. Illustrated.

Nelson Stud Welding Division,
Gregory Industries, Inc.

583—Plaster Aggregate

Bulletin P12 contains complete plastering specifications and fireproofing data for Permalite Perlite plaster aggregate, used as lightweight fireproofing on ceilings, walls and partitions, columns, and beams. Characteristics, advantages, mixing, and application instructions included. Contains charts of typical fire ratings.

Great Lakes Carbon Corp.



584—Galvanized Steel Deck

Catalog U-601, January, 1960, illustrates and describes a multi-purpose light gage, galvanized steel deck. Engineered specifically for short span construction and rigid insulation board. Provides fast, low-cost year-round construction. Catalog includes features, photographs, properties, and load tables.

Granco Steel Products Co.

585—Large Hot-Pressed Nuts

Bulletin 459 contains prices, weights, keg quantities, dimensions of American standard heavy large hot pressed nuts, Hexagon and square used in heavy construction for buildings, bridges, towers, all types of big construction jobs. Size 1⅛ in. thru 4 in. bolt diameter. Steel and engineering specifications.

Jos. Dyson & Sons, Inc.

586—Masonry Wall Reinforcement

This four-page bulletin is printed in two colors and describes Dur-O-waL masonry wall reinforcements. Included are features, advantages, physical properties, and general specifications. Information on cavity wall construction, rod deformation, bonding, and report of tests are also contained in this bulletin.

Dur-O-waL.

STRUCTURAL MATERIALS & EQUIPMENT *continued*

587—Steel Design Manual

First complete published manual containing design instruction for use of high strength steels. Includes fundamental characteristics, design considerations, working unit stresses, tension, compression, shear, deformation and deflection, formed sections, and design against corrosion. Engineering, not sales manual.

U. S. Steel Corp.

588—Sliding Fire Doors

Bulletin DHSL-60 describes Dusing & Hunt's new flush design sliding *Pyro-Dor*. This fire door has UL Class "A" 3 hr fire test rating plus lowest heat transmission rating. Built in sectional interlocking panels, these doors have solid mineral core construction. New *PyroMatic* door release.

Dusing & Hunt, Inc.

589—Monopanl Walls

Bulletin 1728 is a data and specification form outlining, for the consulting engineer, product information and specifications on a new self-sealing insulated wall panel with no visible joints. Butler's new *Monopanl* forms a complete wall, inside and out, factory cut to fit a pre-engineered structural system. Details pictured.

Butler Manufacturing Co.

590—Floor Gratings

Bulletin covers an improved conception for the installation of floor gratings, using the single-span divider-bar, combined with Borden's Type K reversible grating. Simplifies maintenance as well as installation. Bulletin pictures and describes installation at the new Public Service Generating Station, Linden, N. J.

Borden Metal Products Co.

591—Steel Buildings

Catalog 530 describes a complete line of steel buildings for commerce and industry. Twenty pages of full color show buildings available with clear span up to 120 feet. Illustrations show how steel panels combine with other exterior materials to give pleasing appearance. Construction details. Accessories listed.

Inland Steel Products Co.

592—Metal Partitioning

Catalog 6015 gives full installation instructions for erecting metal partition panels in plants, using the *Quick-Erect* patented clips. Cut-away drawings for enclosing tool rooms, store rooms, separations, window guards, folding gates (Bostwick and Lazy Tong Types), and bins. Photographs of actual installations.

Globe Co., Products Division.

593—Sub-Floor Construction

Bulletin contains 28 pages of information on this modern structural, electrical, air conditioning, sub-floor construction. Covers all aspects of Robertson's new high-velocity, dual-duct air conditioning system. Details, specifications, load and property tables, and photographs of actual erection of Q-Air Floor included.

H. H. Robertson Co.

594—Detention Windows

Catalog D-60 describes the complete Bayley line of especially designed detention window systems for penal and mental institutions. Shown are types best suited to various degrees of detention and individual preferences as to fenestration and ventilation. Complete details of design and construction included.

William Bayley Co.

595—Masonry Reinforcements

The all new Sweet's brochure now available. AA Wire Products Company, manufacturers of masonry reinforcement and masonry ties, announce that the all new Sweet's brochure is now available. The new brochure features design drawings, photographs of installations, and suggested guide specifications.

AA Wire Products Co.

596—Steel Curtain Wall

Booklet 91791, entitled "Walls of Steel," fully discusses the selection, fabrication, and erection of steel curtain wall for many recent commercial and industrial buildings. The book is illustrated in full color and describes the use of steel panels as spandrels, column covers, and mullions. Practical and economical.

U. S. Steel Corp.

597—Simple-Span Concrete Beams

Engineering data sheet PC-946 is entitled "Design Procedure for a Simple-Span Prestressed Concrete Beam." This technical bulletin is based on ACI-ASCE Committee 323 report "Tentative Recommendations for Prestressed Concrete." An excellent guide for engineers designing prestressed concrete members.

John A. Roebling's Sons Division.

598—Aluminum Grating

New six-page illustrated bulletin describes the basic advantages of Gary Super *Galok* Aluminum Grating. Outlines its industrial uses for stair treads and other uses decorative and functional. Included are easy-to-use tables of safe loads and weights, panel widths, types and sizes available.

Rockwell-Standard Corp., Grating Div.

STRUCTURAL MATERIALS & EQUIPMENT *continued*

599—Factory Built Steel Buildings

Bulletin ADUCO 30001 pictorially presents the various types of factory built steel buildings utilizing USS steels: galvanized roofing and siding, building frames from structural and plate steels, angles and bars, high strength steels. Advantages of steel building described and types of steel buildings diagrammed.

U. S. Steel Corp.

600—Doors for Special Services

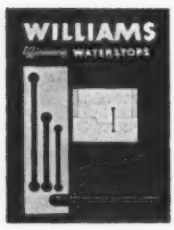
Catalog describes horizontally hinged *spring-assisted* access doors. Complete line includes roof scuttles, smoke hatches, ceiling access doors, flush floor doors, sidewalk doors, basement doors. Specification outlines materials, prices, and weights. Line drawings show operation. Sales offices listed.

BILCO Co.

601—Steel Forms for Concrete

Catalog 245 describes Inland *Ribform*, a permanent steel form for concrete floor and roof slabs. *Ribform* is fabricated from high tensile steel in lengths to meet specifications. Erection is quick and easy. Available in standard, heavy-duty, and super-duty weights; black (uncoated) and galvanized steel finishes.

Inland Steel Products Co.



602—Waterstops

Four-page bulletin WS-59 covering complete line of rubber, vinyl, and neoprene waterstops with molded accessories such as unions, ells, tees, and crosses – both flat and vertical. Includes properties and characteristics, recommendations for use, methods of installing in formwork, and suggested specifications.

Williams Equipment & Supply Co.

603—*Tensilform* for Floors or Roofs

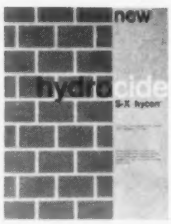
Catalog WC-250-B describes features and gives technical data for Wheeling's permanent steel base for floor and roof slabs. Presents easy-to-use load tables, deflection charts, welding and clipping information, and suggested specifications. *Tensilform* has been designed to speed construction and permit early occupancy.

Wheeling Corrugating Co.

604—Welded and Fitted Railings

Basic engineering data and standards for railing design are included in this catalog on welded and fitted railings for a wide variety of uses. Pictorial check of fittings, provides immediate identity, fast selection for specific applications. Details for incorporation in drawings and specifications are included.

Tubular Products, Inc.



605—Water Repellent for Masonry

Hydrocide S-X Hycon is described in bulletin BP3062. The exclusive all-new Hycon® silicone imparts longer effective water repellency to exterior masonry surfaces. Charted in the bulletin is a summary of rigid tests conducted on the premise that water absorption increases upon continued exposure to freeze-thaw.

Sonneborn Chemical & Refining Corp.

606—Steel Buildings

Catalog B-2059 describes the new line of Armco steel buildings. Four basic types provide clear span widths ranging from a few feet to 120 feet. Many features include special durable metals. Catalog provides complete engineering data and specifications. Commercial and industrial installations in full color.

Armco Drainage & Metal Products, Inc.

607—Prestressed Concrete Members

The rapid growth in the use of precast pretensioned bonded prestressed concrete members confirms their several advantages over competitive materials. Bulletin PC-945 describes application and productions, and covers buildings, bridges, piles, casting bed details, and tensioning data. Fully illustrated.

John A. Roebling's Sons Division.

608—Welded Steel Grating

New eight-page illustrated bulletin describes Gary welded steel grating and treads. Has easy-to-use table of safe loads, weights and symbols, and panel widths. Included is data on fastening devices illustrated by drawings. Information on specifying grating and tread.

Rockwell-Standard Corp., Grating Division.

H. H. Robertson Co.

This 32-page booklet contains a wealth of technical information on Robertson Galbestos — information that will be helpful in handling and installing this high quality protected metal . . . includes standard corrugations, purlin and girt spacing, load tables, weights and gages, erection instructions.

H. H. Robertson Company.

610—Service Fittings

Bulletin 493 illustrates design features, simplicity of assembly of new *Spang* service fittings, suitable for use with underfloor distribution systems of any manufacturer. Covers individual power and phone fittings and includes illustrations of linoleum, pan, terrazzo holder, plus part numbers, and ordering information.

National Supply Co.

STRUCTURAL MATERIALS & EQUIPMENT *continued*

611—Insulated Metal Curtain Wall

Insulated metal walls and wall panels of various types, and Underwriters' rated fire walls, with over-all "U" factor superior to that of a conventional masonry wall with furred lath and plaster, are described in 16-page bulletin W-58. Materials, construction, thermal properties are given, with construction details.

R. C. Mahon Co.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

612—Stainless Steel Roofs and Walls

Bulletin ADUCO-03-19014 contains a comprehensive discussion of the many advantages of stainless steel walls and roofs for industrial and semi-industrial buildings. Pertinent data section includes corrosion resistance, characteristics, grades, thickness, and forms and finishes. Comparative erection costs.

U. S. Steel Corp.

613—Rolling Doors

Bulletin 104, 36 pages, is a complete catalog of the many types of doors made by Kinnear. It gives information on the types of operations, both manual and electrical; elevation drawings, mounting methods for various applications and locations; specifications; and explains special construction features of these doors.

Kinnear Manufacturing Co.

614—Vinyl-Coated Corrugated Steel

Catalog V-91 describes a new vinyl protected corrugated steel – Granco *Vin-Cor*. Used in industrial and commercial buildings of all types. Available in nine standard colors and a wide selection of gages and patterns. Full color catalog gives color selection, section properties, typical details, and specifications.

Granco Steel Products Co.

615—Large Construction Fasteners

Bulletin 160 covers large fasteners for the heavy construction and machinery industries. Large forged standard and special purpose nuts, bolts, threaded rods, loop rods, eye bars, construction accessories, size 1¾ in. thru 12 in. bolt diameter. Illustrated with photographs of standard and special large fasteners.

Jos. Dyson & Sons, Inc.

616—Roof Coatings

Bulletin describes Dry-N-Tite liquid, plastic, aluminum, and primer roof coatings for patching, resurfacing, and coating build-up composition on corrugated or sheet metal, slag, gravel, concrete, and felt roofs. Roofs can be patched when damp or wet.

A. C. Horn Companies,
Division of Sun Chemical Corp.

617—Insulating Concrete

Bulletin C12 contains complete specifications, mixing, and application instructions for Permalite Perlite insulating concrete. Roof deck and floor fill applications are illustrated and discussed. Engineering data, including safe uniform loads, and physical properties on roof deck systems, are included.

Great Lakes Carbon Corp.

618—Shear Connectors

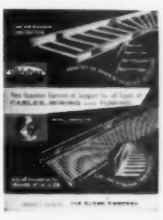
Design Data describes the design and benefits of Nelson stud shear connectors for composite design of bridges and buildings. Types of shear connectors shown in line drawings. Bulletin includes installation photographs, tables, illustrative examples, and specifications.

Nelson Stud Welding Division,
Gregory Industries, Inc.

619—*Slope-Beam* Steel Buildings

Catalog 4010 describes designs possible with new *Slope-Beam* buildings. Low-profile or flat roof through simple beam inversion. In clear spans up to 80 ft. or multiple spans to almost unlimited width without need for interior roof valleys. Companion catalog 4011 with component specification data also sent.

Inland Steel Products Co.



620—Cable, Wiring, Tubing Supports

Two systems of support for all types of cable, wiring, and tubing are described in a 28-page illustrated catalog. Systems are engineered to be used interchangeably, depending on the weight of the load to be supported at any location. *Globetray*, the ladder-type tray, and cable-strut, the basket type, described.

Globe Co.

621—Rubber Control Joints

Four-page bulletin describes *Rapid* wide flange and *Rapid* regular rubber control joints for use in masonry walls. Included are features, advantages, physical properties, general specifications. Line drawings show both types with dimensions, also method of application are included in this bulletin.

Dur-O-wal.

STRUCTURAL MATERIALS & EQUIPMENT *continued*

622—Reinforced Plastic Panels

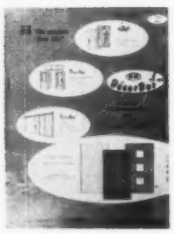
Bulletin 1717RSF describes *Stylux*, the reinforced plastic panel, manufactured by Butler. Panels are used for commercial and industrial skylighting, window glazing, and ornamentation. Information especially for the use of consulting engineers includes specifications, product data, and installation details.

Butler Manufacturing Co.

623—Steel and Aluminum Grating

This 16-page catalog shows the three basic types of grating construction; gives more than 30 dimensional drawings of subtypes; eight safe load tables covering steel and aluminum grating, roadway grating, and sidewalk slabs; tables on panel widths, tread widths, and floor armor. Planning layouts are given.

Borden Metal Products Co.



624—Metal and Wood Doors

Bulletin DHSV-60 describes the D & H *Decor-Dor* line of flush-design vinyl-on-steel, aluminum, and wood doors. Natural color illustrations show color and vinyl texture. Outstanding features of all models, construction, sizes, and types of doors included. Wood doors have *PyroDor* structural mineral cores.

Dusing & Hunt, Inc.

625—Tracing Templates

Scale detailed drawings of horizontally hinged *spring-assisted* doors. Complete line includes roof scuttles, smoke hatches, ceiling access doors, floor doors, pit doors, and basement doors with steel stair stringers. Specifications, standard sizes, and weights included. Sales offices in this country and Canada listed.

BILCO Co.

626—Fluted Steel Foundation Piles

Catalog No. 91, 24 pages, contains information on physical properties and design features, standard weights and volumes of Monotube fluted, steel foundation piles. Included are photos of typical installations, test driving data, and other technical data of particular interest to consulting engineers.

Union Metal Manufacturing Co.

627—Glass-Protected Smokestacks

Bulletin SS-202A describes *Permaglas* smokestacks, protected against corrosive flue gases. Features include longer life, low maintenance, lightweight, and easy installation. Chart shows how *Permaglas* stacks cost less over a period of years. Special *Permaglas* sections, smokestack accessories, and typical installations.

A. O. Smith Corp.

628—Curtain Wall Systems

Catalog C-60 outlines Bayley aluminum or steel curtain wall systems and insulated panels with Bayley aluminum projected windows. Advantages of Bayley curtain walls include choice of distinctive wall treatment without cost of special design, a wall engineered to accommodate a building's movement.

William Bayley Co.

629—Foundation Pipe

Catolog FP-13558 describes three basic types of foundation pipe, pipe piles, caissons, and *Hel-Cor* pile shells for use under bridges, buildings, and other structures. Typical installations, dimensions, properties, and specifications are given. Data on pile driving hammers and pile bearing capacity.

Armco Drainage & Metal Products, Inc.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 62 and 63.

630—Metal Lath and Accessories

Milcor Catalog 202 contains illustrations, installation details, load tables, descriptions, and product data on this complete line of lathing and plastering accessories for firesafe construction. Also included are *Milcor* interior metal trim and products for use with acoustical plaster and tile.

Inland Steel Products Co.

631—Cements and Bonding Compounds

Indexed price chart and data sheets describe the various types of cements and bonding compounds made by Sauereisen Cements Company. Charted, along with wholesale prices, is special industrial and technical data. Each sheet included describes a different type of adhesive or bonding compound. Illustrated.

Sauereisen Cements Co.

632—Steel Stair Treads

Tread-Grip steel stair treads combine strength of construction with safe, nonslip footing, according to four-page bulletin HTP2130. This brochure describes such features as *A. W. Algrip* nosing, electroforged and welded construction, and twisted cross bars. Included are detail drawings and dimensions.

Horace T. Potts Co.

STRUCTURAL MATERIALS & EQUIPMENT *continued*

633—Aluminum Paints in Color

Four-color brochure 30-11457 covers the newly-developed colored aluminum paint. The colorful paint's uses on various surfaces, its characteristics, and its advantages are outlined. Application directions and coverage tables for various types are included. Various applications listed and illustrated.

Aluminum Company of America

634—Marzaic and Broomed Panels

This new 8-page full color catalog showing samples of Marietta Marzaic and broomed finish surfaces is now available. The catalog includes photographs, construction details, specifications on Marziac and broomed panels, and other facts on many company services.

Marietta Concrete Division
American-Marietta Co.

635—Chord Steel Joists

New 52-page bulletin contains complete data on Laclede straight chord steel joists, "S" and "L" Series. The bulletin includes numerous photographs, drawings and charts, plus such detailed information as design and construction features, dimensions and specifications, load and spacing tables, installation data.

Laclede Steel Co.

636—Metal Grating and Stair Treads

This 16-page, 2-color bulletin is a picture story of Kerrigan Iron Works. Shows how grating is fabricated into various forms and cutouts. Bulletin contains standard table of safe loads, engineering data, data on various types of anti-skid stair treads, and testing methods. Pictures gratings and stair treads.

Kerrigan Iron Works, Inc.

637—New Ties for Masonry Walls

A new technical brochure features new anchors and ties for bonding modular masonry veneer to modular masonry backup. Also featured are nail-on anchors for anchoring masonry veneer to existing surfaces. Engineering drawings illustrate products use and specifications describe product application.

AA Wire Products Co.

638—Trackless Turnover Doors

Bulletin BB-160 describes the new *Byrnover* door manufactured by Byrne Doors, Inc. This is a trackless turnover door that opens and closes twice as fast as other industrial doors. Requires minimum head and jamb clearance, has positive safety features, and provides cost advantages. All specifications listed.

Byrne Doors, Inc.

639—Pozzolith, Prestressed Concrete

Bulletin P-13 explains how *Pozzolith*, the admixture for concrete, when used in prestressed concrete increases production and improves quality. Contains 16 case histories describing various applications in the use of *Pozzolith*. Each case history is completely illustrated with operational pictures.

Master Builders Co.

640—Asbestos-Cement Structural Sheet

Bulletin BM-231 describes "K&M" *Kamwall*, the first flexible and fireproof asbestos-cement structural sheet. "K&M" *Kamwall* can be stapled or nailed without pre-drilling, cut with an ordinary saw. The bulletin covers the features and suggested uses of "K&M" *Kamwall*, plus its physical properties.

Keasbey & Mattison Co.

641—Grating and Stair Treads

Bulletin 1111 describes the complete line of Dravo welded and inter-locked floor grating, stair treads, armoring, and T-bar flooring. Also included are pertinent dimension and load tables for both steel and aluminum alloy. Various types of gratings are illustrated. Ordering information is included.

Dravo Corp.

642—Pressure Grouting Services

Brochure PGS-0002 describes Halliburton Pressure Grouting Services including equipment, personnel, and materials for any size grouting job, a dependable and convenient method of metering, mixing, placing grouting materials continuously. Selection of special chemical grouting fluids and cement grout slurries.

Halliburton Oil Well Cementing Co.

643—Structural Bolts

Catalog describes Lamson high strength bolts for buildings, bridges, towers, and other applications, that give maximum holding power. Bolting principles, ordering data, prices are included. Bolt is distributed by 20 U. S. Steel Supply Division Steel Service Centers in key locations throughout the country.

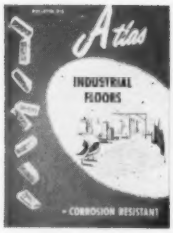
Lamson & Sessions Co.

644—Duct Floors for Electrification

Sixteen-page booklet, "Electrical Outlets Wherever You Need Them," gives complete details on RLC duct floors, a new development which provides 100 percent electrical flexibility for buildings at a remarkably low cost. The illustrated booklet is published by the Concrete Steel Reinforcing Institute.

Concrete Steel Reinforcing Institute.

STRUCTURAL MATERIALS & EQUIPMENT *continued*



645—Industrial Floors

Bulletin 3-3 describes Atlas corrosion-resistant industrial floor "individually engineered" for each specific problem. Construction methods and material quantity estimating table are also included. Two types of flooring are described: Alkor furfuryl alcohol resin and Vitrobond plasticized hot pour sulfur base.
Atlas Mineral Products Co.

646—Metal Grating and Treads

General grating catalog F-400 contains illustrations, descriptions, and complete engineering data on grating flooring, treads, and floor armoring (riveted, press-locked, and welded types). Irving grating is safe, durable, fireproof, ventilating, clean, and economical for industrial and power plant flooring and stairways.
Irving Subway Grating Co., Inc.

647—Cable and Tubing Support Systems

Chalfont Support system utilized for carrying instrumentation tubing, process tubing, piping, and control cables. Recommended for more economical, and faster installation over previous type systems. Completely pre-engineered and available with all accessories. Aluminum, galvanized steel and aluminized steel.
Chalfont Products Co.

648—Slag in Industrial Construction

Bulletin ADUCO-80005 is a full color booklet designed to acquaint the consulting engineer with air-cooled, granulated, and expanded blast furnace slag. This general bulletin discusses slag in foundations, pavements and structures, flooring, railroad ballast, roofing, and flexible pavements. Advantages listed.
U. S. Steel Corp.

WASTE DISPOSAL EQUIPMENT

649—Sewage Pumping Station

Complete engineering data manual on factory-bilt sewage pumping stations plus complete lineup of pneumatic ejector lift stations. Features design, operation, specifications, and selection data. Includes colorful bulletins on pump station, S&L sewage pump, and ejector stations. Full color cutaway shows components.
Smith & Loveless.

650—Sewage Lift Stations

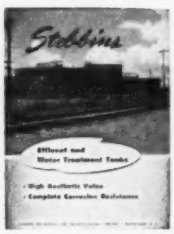
Bulletin DJ-60 describes the *Delta-Ject* packaged pneumatic sewage lift station manufactured by Tex-Vit Supply Company, Manufacturing Division. A duplex unit available in 29 to 200 gpm, it features exclusive shell-within-shell design. Bulletin provides engineering data, specifications, and dimensional drawings.
Tex-Vit Supply Co., Mfg. Division.

651—High Capacity Aerator

Bulletin 7316 describes the D-O Aerator for application in both municipal sewage and industrial waste treatment plants. Can be adapted to a variety of tank sizes and is readily incorporated into existing tanks. Cutaways show aerators installed in round tank as well as in rectangular tank. Diagrams show flow.
Dorr-Oliver Inc.

652—Oxidation-Type Sewage Plant

Bulletin 6520 describes the *Accelo-Biox*® complete oxidation-type plant for sewage treatment. Low per capita cost. Standardized equipment applications for installation in steel or concrete basins. Full range of sizes using either atmospheric or compressed air. Bulletin gives selection data and specifications.
Infilco Inc.



653—Treatment Tanks

Bulletin AET-59 contains full-color illustrations of water and effluent treatment tanks. They are steel-reinforced concrete structures faced on both sides with vitrified tile laid with corrosion-resistant mortar. Tanks are exceptionally attractive in appearance. Included are drawings showing wall construction.
Stebbins Engineering and Mfg. Co.

654—Sewage Treatment Plant

This data manual on the S&L "Oxigest" sewage treatment plant contains notes on design, engineering data, specifications, and installation instructions plus lists of accessory equipment. Now 27 standard sizes; factory-built units for small subdivisions, schools, motels, factories in need of dependable sewage treatment.
Smith & Loveless, Inc.

WASTE DISPOSAL EQUIPMENT *continued*

655—Packaged Sewage Pump Stations

Bulletin PS-60 describes the Tex-Vit packaged sewage pump station. Available in 50 to 2,000 gpm capacities, these are duplex units complete with motors, pumps, controls, dehumidifying unit, corrosion-resistant steel shell, and entrance tube. Bulletin includes engineering data, specifications, and dimensional drawings.

Tex-Vit Supply Co., Mfg. Division.

656—Small Area Sewage Treatment

Bulletin 7315 describes complete sewage treatment in single unit for population equivalent of 150 persons. Explains development, design, operation, and advantages of *CompleTreator.* This single unit ideally suited for housing developments, motels, restaurants, schools, and domestic type wastes from industrial activities.

Dorr-Oliver Inc.

WATER TREATMENT EQUIPMENT

657—Automatic Water Softeners

Bulletin 400A describes automatic water softeners for heavy duty service. Complete specifications are listed for 17 stock models, with installation diagrams and operation information included. Stock models in capacities up to 1.5 million grains, single unit; 3 million grains, twin unit. Flow rates are up to 175 gpm.

Bruner Corp.

661—Loveitrol System

Bulletin B659P describes a system for wet storage brinemaking which proportionately replaces water as brine is withdrawn. Permits accurate salt inventory; prevents overflow loss; eliminates corrosion of moving parts. Line drawings show different types of assemblies for different brine use systems.

Morton Salt Co.

658—Automatic Control Systems

Bulletin E describes the automation of ion-exchange and water treatment equipment. A suggested specification is included, together with typical illustrations and descriptions of important design features. Automatic control systems described are adaptable to any automatic valve sequencing operation.

Illinois Water Treatment Co.

662—Cation Exchanger

Bulletin Z-12 presents complete technical information on *Nalcite* HCR-W, new stress-free cation exchanger. Explains hydrogen cycle and sodium cycle operations and discusses use of HCR-W in industrial and municipal applications. This product is manufactured by the Dow Chemical Co. for Nalco.

Nalco Chemical Co.

659—Filter Plants

Filter plants for the removal of iron, manganese, taste, odor, and gas are described in a new General Filter bulletin. Various problems are listed and answers given. Four basic treatment methods are described and graphically shown in drawings. Actual installations in all parts of the country are shown.

General Filter Co.

663—Swimming Pool Filters

New 24-page technical bulletin for consulting engineers on swimming pool filters for municipal, public, and institutional pools. Contains typical installations, cross-section and operational drawings, charts, and factual comparison. This manufacturer does not offer a filter for backyard type pools.

R. P. Adams Co., Inc.

660—Automatic Water Softeners

Simplicity of design in a motorized multiport valve brings automatic operation within the range of any who need a heavy duty zeolite softener. The Elgin Automatic described in bulletin 616 is available in single unit capacities up to 2,000,000 grains and double units up to 4,000,000 grains.

Elgin Softener Corp.

664—Water Demineralizers

Bulletin describes Carma de-ionizers and principal features such as the *Hydroion* meter and multi-port valve. Points out the difference between distilled and demineralized water, uses for de-mineralized water, and standard Carma models available. Flow diagrams show how a de-ionizer works.

Carma Manufacturing Co.

WATER TREATMENT EQUIPMENT *continued*

665—Water Softeners

Bulletin 4696 describes Permutit's new Model BD water softeners designed for a wide range of commercial and industrial applications. Simplification and standardization permit economical price and prompt shipment from stock. Included is features, design specifications with schematics, and specifications.

Pfaudler Permutit Inc.

666—Diatomite Pressure Filters

Bulletin 2-323 covers the line of Bruner diatomite pressure filters for swimming pools. Standard filters are available in sizes from 12 to 672 sq ft. Features include a septum with interlocking plastic disc core and plastic cloth sleeve. Schematic diagrams and comparison charts for diatomite and sand filters.

Bruner Corp.

667—Upflow Clarifiers

In bulletin 5811 models C, CP, CPS, P and CF of General Filter Company's upflow clarifiers are described and illustrated. Flow charts and important features, essential to economical and efficient operation, are included. Typical contraflo industrial, utility, and municipal installations are shown and described.

General Filter Co.

668—Water Treatment Equipment

Bulletin 615 is a booklet on water treating equipment describing manual and automatic zeolite softeners, mixed-bed and multi-column deionizers, dealkalizers, ion exchangers, filters, purifiers, aerators, and degasitors. Also covers spray and tray type deaerating heaters and water treating chemicals.

Elgin Softener Corp.

669—*Illco-Matic* Decarbonator

Bulletin D-160 describes a Decarbonator of unique design, which is used for removal of dissolved gases from water by aeration, without the use of a blower or compressed air. Features include low head room, package design, easy installation, and quiet, economical operation. Diagram shows operation.

Illinois Water Treatment Co.

670—Water Treatment Plant

Bulletin 1825 describes the *Accelator* water treating plant, its history, operational features, and its many applications in both the municipal and industrial field's. The ABC's of the plant are shown in two-color schematics. Design considerations are listed and explained. Plant layouts and suggested specifications.

Infilco, Inc.

671—Brinemakers

Bulletin B160A describes Morton's Model E Series brinemakers using the exclusive Morton *Fluitron*. Function, performance data, installation procedures, and operating instructions are included in this bulletin. Line drawing shows construction and operation. Component parts shown and named. Product photographs.

Morton Salt Co.

672—Anion Exchangers

Bulletin Z-13 presents complete technical data on four strongly basic *Nalcite* anion exchangers; explains conditions under which each is recommended for mixed bed or multibed demineralization, including nuclear power reactor applications. Also discusses dealkalization procedures. Illustrated with graphs.

Nalco Chemical Co.

673—Packaged Demineralizers

Bulletin 4721 describes Permutit's new standard packaged demineralizers available from stock including skid-mounted, fully assembled models. Capacities from 22,000 to 100,000 grains and flow rates up to 73 gpm. Includes mixed-bed, two-step, non-regenerable demineralizers. Summary of properties in table form.

Pfaudler Permutit Inc.

674—Water Control Equipment

Bulletin 315 illustrates, and provides, specifications for, the complete line of Sparling propeller-type main-line meters, recording instruments, and control equipment. Various applications, flow ranges, sizes, cut-away drawings, and installation information are all included. Pictured are production and test equipment.

Hersey-Sparling Meter Co.

675—Water Works Brass Goods

Water works brass goods bulletin WW-58 illustrates and describes McDonald water service products. Included are curb stops, corporation stops, goosenecks, meter stops and couplings, service pipe couplings, and extension service boxes. Each product offered is pictured with description and necessary specifications.

A. Y. McDonald Mfg. Co.

676—Water Gate Hoists

Catalog GH-353 describes gate hoists specifically designed to control water levels on hydro-electric power plant installations. Illustrates some typical hoists. Lists types of stationary and traveling gate hoists and the types of power dam gates for which they are applicable. Capacities from 1 to 100 tons.

D. J. Murray Manufacturing Co.

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